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Global
Equity Research
Investment Strategy

Higher agricultural prices: Opportunities and risks

THEME

The New Perspectives Series

Credit Suisse realizes that in the current geopolitical environment, investing opportunities are not always easily categorized by industry sectors. Emerging issues and macroeconomic trends often involve companies across sectors and regions of the world. In this "New Perspectives" Series, research analysts join together, often times with the help of our equity strategists, to craft in-depth thematic analysis highlighting the issues at hand and the companies poised to benefit.

Agricultural markets are straining to keep up with demand, and prices have been spiralling upwards. Is this a temporary issue? We think not.

We believe that global food production needs to grow at 2.5% per year just to keep pace with the dietary needs of its population, and we estimate that biofuels expansion adds another 80 bps to the demand growth for agricultural products over the next five to eight years. Thus, agricultural production would need to grow at 3.3% per annum in order to meet total global demand.

Acreage expansion potential appears limited, given rising environmental concerns, urbanisation and land degradation. We believe the onus, therefore, is on productivity growth. However, in the case of cereals, productivity has grown at only 1.3% in the past 20 years. This implies that agricultural prices will continue to rise.

We view emerging markets, with a greater proportion of land and labour dedicated to agriculture, as relative winners in this environment. Developed markets, which on average are net importers of agricultural products, appear less likely to benefit.

To play the theme, we present the Credit Suisse Agriculture 20: Bunge, SLC Agricola, ALL (America Latina Logistica), Indofood Agri, London Sumatra, Illovo Sugar, Sime Darby, Banco do Brasil, China Mengniu, Agrium, Deere & Co, AGCO, BrasilAgro, Kellogg, Wrigley, Sadia, Mosaic Co, Astra Agro, Kuala Lumpur Kepong and IOI Corp.

Research Analysts

Andrew Garthwaite
44 20 7883 6477
andrew.garthwaite@credit-suisse.com

Mary Curtis
44 20 7888 1000
mary.curtis@credit-suisse.com

Charlie Mills
44 207 888 0325
charlie.mills@credit-suisse.com

Rob Moskow
1 212 538 3095
robert.moskow@credit-suisse.com

Tingmin Tan
603 2723 2080
tingmin.tan@credit-suisse.com

Mark Connelly
1 212 325 5844
mark.w.connelly@credit-suisse.com

Luiz Campos
55 11 3841 6812
luiz.otavio-campos@credit-suisse.com

Roberto Attuch
55 11 3841 6307
roberto.attuch@credit-suisse.com

Mark Flannery
1 212 325 7446
mark.flannery@credit-suisse.com

ANALYST CERTIFICATIONS AND INFORMATION ON TRADING ALERTS AND ANALYST MODEL PORTFOLIOS ARE IN THE DISCLOSURE APPENDIX. FOR OTHER IMPORTANT DISCLOSURES, visit www.credit-suisse.com/researchdisclosures or call +1 (877) 291-2683 U.S. Disclosure: Credit Suisse does and seeks to do business with companies covered in its research reports. As a result, investors should be aware that the Firm may have a conflict of interest that could affect the objectivity of this report. Investors should consider this report as only a single factor in making their investment decision. Customers of Credit Suisse in the United States can receive independent, third party research on the company or companies covered in this report, at no cost to them, where such research is available. Customers can access this independent research at www.credit-suisse.com/ir or call 1 877 291 2683 or email equity.research@credit-suisse.com to request a copy of this research.

Analyst contact list

Product Co-ordinators

Mary Curtis	+44 207 888 1000	mary.curtis@credit-suisse.com
Richard Kersley	+44 207 888 0313	richard.kersley@credit-suisse.com
Gary Balter	+1 212 538 4228	gary.balter@credit-suisse.com

Strategy

Andrew Garthwaite	+44 207 883 6477	andrew.garthwaite@credit-suisse.com
Mary Curtis	+44 207 888 1000	mary.curtis@credit-suisse.com
Marina Pronina	+44 207 883 6476	marina.pronina@credit-suisse.com
Mark Richards	+44 207 883 6484	mark.richards@credit-suisse.com
Sebastian Raedler	+44 207 888 7554	sebastian.raedler@credit-suisse.com
Jonathan Morton	+1 212 536 9853	jonathan.morton@credit-suisse.com
Alex Redman (EMEA)	+44 207 888 6896	alex.redman@credit-suisse.com

Banks and agricultural lending

Aditya Singhania	+9122 6777 3718	aditya.singhania@credit-suisse.com
Roberto Attuch	+55 11 3841 6307	roberto.attuch@credit-suisse.com

Agricultural Machinery

Haider Ali	+65 6212 3064	haider.ali@credit-suisse.com
Jamie Cook	+1 212 538 6098	jamie.cook@credit-suisse.com
Teruhiko Nishimura	+81 3 4550 9929	teruhiko.nishimura@credit-suisse.com

Food retailers

Jay Carlington	+1 212 538 8038	jay.carlington@credit-suisse.com
Edward Kelly	+1 212 325 3241	edward.kelly@credit-suisse.com
Andrew Kasoulis	+44 20 7888 0324	andrew.kasoulis@credit-suisse.com
Katsura Kihara	+81 3 4550 9937	katsura.kihara@credit-suisse.com
Xavier Le Mene	+44 20 7888 1199	xavier.le-mene@credit-suisse.com

Transportation

Ivan Fadel	+55 11 3841 6316	ivan.fadel@credit-suisse.com
Greg Lewis	+1 212 325 6418	gregory.lewis@credit-suisse.com

Bio-fuels

Mark Flannery	+1 212 325 7446	mark.flannery@credit-suisse.com
Will Forbes	+44 20 7883 7263	will.forbes@credit-suisse.com
Luiz Otavio Campos	+55 11 3841 6312	luizotavio.campos@credit-suisse.com
Rafael Camargo	+55 11 3841 6306	rafael.camargo@credit-suisse.com
Edward Westlake	+44 20 7888 9114	edward.westlake@credit-suisse.com

Agricultural producers and processors

Haider Ali	+65 6212 3064	haider.ali@credit-suisse.com
PI Aquino	+312 750 2993	pl.aquino@credit-suisse.com
Annuar Aziz	+603 2723 2084	annuar.aziz@credit-suisse.com
Brendan Grundlingh	+27 11 374 2113	brendan.grundlingh@csss-sa.com
Catherine Lim	+852 2101 6323	catherine.lim@credit-suisse.com
Robert Moskow	+1 212 538 3095	robert.moskow@credit-suisse.com
Teddy Oetomo	+62 21 2553 7911	teddy.oetomo@credit-suisse.com
Luiz Otavio Campos	+55 11 3841 6812	luiz.otavio-campos@credit-suisse.com
Tingmin Tan	+603 2723 2080	tingmin.tan@credit-suisse.com

Packaged Food

PI Aquino	+312 750 2993	pl.aquino@credit-suisse.com
Chinnarat Boonmahanark	+662 614 6216	chinnarat boonmahanark@credit-suisse.com
Guillaume Dalibot	+44 207 888 1087	guillaume.dalibot@credit-suisse.com
Sindi Daniso	+27 11 384 2218	sindi.daniso@csss-sa.com
Jinsong Du	+852 2101 6589	jinsong.du@credit-suisse.com
Sonia Kim	+822 3707 3764	sonia.kim@credit-suisse.com
Catherine Lim	+852 2101 6323	catherine.lim@credit-suisse.com
Charlie Mills	+44 207 888 0325	charles.mills@credit-suisse.com
Alex Molloy	+44 20 7888 0848	alex.molloy@credit-suisse.com
Robert Moskow	+1 212 538 3095	robert.moskow@credit-suisse.com
Yukiko Oshima	+81 3 4550 9045	yukiko.oshima@credit-suisse.com
Victoria Petrova	+7 495 967 8393	victoria.petrova@credit-suisse.com
Tufic Salem	+52 55 5283 8952	tufic.salem@credit-suisse.com
Foong Wai Loke	+603 2723 2082	foong.wai-loke@credit-suisse.com
Arief Wana	+62 21 2553 7977	arief.wana@credit-suisse.com

Chemicals and ag science

Mark W. Connelly	+1 212 325 5844	mark.w.connelly@credit-suisse.com
Rohan Gallagher	+ 612 8205 4858	rohan.gallagher@credit-suisse.com
Pascal Spano	+49 69 75 38 2272	pascal.spano@credit-suisse.com
Masami Sawato	+81 3 4550 9729	masami.sawato@credit-suisse.com
Jinsong Du	+852 2101 6589	jinsong.du@credit-suisse.com
Sidney Yeh	+886 2 2715 6368	sidney.yeh@credit-suisse.com

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Executive summary

Agricultural markets are straining to keep up with demand, and prices have been spiralling upwards. Is this a temporary/cyclical issue? We think not. There are structural issues afoot here and agricultural production is simply not growing fast enough to meet demand.

In this report we explore the dynamics of both global demand and supply and consider the implications for the next few years. Specifically:

Demand

- We believe that global food production needs to grow at 2.5% per year (roughly in line with the historical rate of 2.3%) just to keep pace with the dietary needs of its population. This comprises population growth (which adds about 1.1% pa to world food demand), increased calorie intake (another 0.8% pa) and changing diet (another 0.6% pa) as consumers, particularly in the emerging markets, eat more meat. This rate of growth is in line with UN forecasts of a 67% required increase in food production for developing countries by 2030.
- Biofuels expansion is a new element in the demand for agricultural produce that we think will increase demand growth by 80 bps over the next five to eight years. We estimate that the combined impact of government-set biofuel targets globally commits 238m acres, or 12% of the total arable and permanent cropland, to biofuel feedstock production over the next 10–15 years. The US's biofuel target implies that (on current technology) 19–32% of total domestic arable acreage would need to be committed to biofuel production by 2017, up from 5.7% now.
- These figures mean that agricultural production would need to grow 3.3% per annum, on our estimates, in order to meet total global demand for food and biofuels.

Supply

- Global agricultural production is not growing fast enough to meet these demands.
- Acreage expansion potential is questionable given rising environmental concerns, urbanisation (China is losing 0.6% of agricultural land pa owing to urbanisation alone) and land degradation. Some countries have acreage expansion potential (Brazil, Argentina and Indonesia), but others do not (the US, China). We think it unlikely that much land will be released early from the US Conservation Reserve Program (CRP) and European set-aside can only add 0.42% to global cereal acreage. Latin America has significant potential: if all the potential arable land were used in Argentina, Brazil, Paraguay and Colombia then global arable acreage could rise by 11.8%. However, there are significant structural constraints, thus the US Department of Agriculture (USDA) forecasts just 4.5% growth pa in Brazilian agricultural land over the next 10 years. This bodes well for Brazil's market share, but relative to global acreage, it still represents only 0.1% growth pa. Indonesia also has plenty of capacity to add to the global pool of arable acreage, although we would expect considerable resistance from the NGOs if the local farmers encroach on virgin jungle.
- Hence, we expect growth in acreage expansion to be fairly slow. If we assume that half of the total potential in Indonesia and South America can be realised over the next 10 years, it still only equates to just less than 1% pa. The onus, therefore, is on growth in productivity. However, in the case of cereals, global productivity has grown at an average 2.0% over the past 45 years, but only 1.3% in the past 20 years. The pace of productivity growth has declined despite advances in genetically modified seeds.
- Declining inventories of grains is a sign that the world has had trouble keeping up with demand in recent years. US corn stocks now stand at just 13.5% of consumption, the lowest level for 35 years and well below the average of the last 20 years of 24.4%.

The implications

- Food price inflation is likely to remain elevated over the next three to five years, until (and if) supply growth can catch up with demand. Despite strong rises in the past two years, in real terms food prices are still 15% below their 30-year average.
- Rising food prices may eventually encourage producers to increase production in areas of the world that had previously been unattractive economically (ultimately relieving some of the pressure on tight markets and taking the edge off prices). Note the recent proposal from European Commissioner for Agriculture and Rural Development, Mariann Fischer Boel, to end the ruling whereby farmers leave 10% of their land fallow.
- Perhaps more emotively, the issues of genetics will inevitably be closely debated again and, we believe, increasingly used globally (e.g. the recent shift in Japan to allow GM crops for biofuel production). The penetration rate of genetic crops is still very low. Even in the US, where their use is most widely accepted, just less than a third of arable land is from GM seeds.
- There may be some back-tracking on government biofuel targets (as has been the case in China and Malaysia recently) and protectionist measures to limit the impact on the domestic market (Indonesia, for instance, just raised to 10% its export tariff on palm oil in order to cool domestic prices).
- Profits for the ethanol producers have fallen rapidly in the face of rising corn (and other feedstock) prices and the bottlenecks in ethanol distribution channels. Ethanol production growth has been rapid but without the distribution channels to deliver to market, a glut has quickly built up. In the past 16 months, wholesale ethanol prices have underperformed gasoline prices by 67% in the US. It no longer makes sense to build new ethanol capacity given the prevailing price of ethanol and corn; as such new build plans have, in many cases, been postponed or cancelled. What next? We expect ethanol relative to gasoline prices to recover rather than corn prices to fall: (1) distribution channels should improve (there is already evidence that two big new markets, Florida and Georgia, will open up via rule changes in early 2008; (2) there is evidence that independent retailers are seeking to blend ethanol due to the overwhelmingly attractive economics given the steep ethanol discount to conventional gasoline); and (3) we do not expect the US or EU governments to back-track on their biofuel targets providing the long-term goal for the industry.
- Food as a proportion of CPI is 10% in the UK, 15% in the US, 16% in the EU and 26% in Japan. The numbers are much higher within the emerging markets (50% in the Philippines and 33% in China, for instance). At some point, Central Banks will probably have to respond to higher food prices but that only happens when wage growth starts to accelerate. The winners are those countries with proportionately large agricultural exports and a high proportion of agriculture within GDP. Brazil fits the bill (agriculture accounts for 27% of GDP and net agricultural exports make up 24% of total exports). Higher agricultural prices are likely to further enhance the current account surpluses of Argentina, Brazil, Malaysia and Indonesia, adding to the pressure on their currencies to appreciate.

Stock implications

- With 15% of the world's fresh water supply and 106m hectares of land available for potential acreage expansion, Brazil is likely to be the sweet spot for global financial investment in agricultural production. We think grain processors **Bunge** and **SLC Agricola** (as well as **BrasilAgro**, the agricultural real estate company) are uniquely positioned to capitalise on this trend. Bunge is the leader in Brazilian soy processing and fertiliser production and is the largest exporter of soybeans to China. Bunge's vast experience in Brazilian agriculture and its relationships with Brazilian farmers is a competitive advantage when searching for and negotiating for assets, in our view.

- Within the foodchain, value shifts away from the consumer towards the raw material producers and processors. Note that sugar and palm oil are by far the most efficient feedstocks in the production of ethanol and biodiesel. As well as **Bunge, SLC Agricola** and **BrasilAgro** in Brazil, we highlight **Indofood Agri** and **London Sumatra** in Indonesia, **Illovo Sugar** in South Africa and **Sime Darby, Golden Hope Plantations, KL Kepong** and **IOI Corporation** in Malaysia as potential beneficiaries. Our global basket of crop producers trades on a 15.5x 2007E P/E, which leaves it looking relatively cheap against other sectors.

- An indirect play on the same theme, in our view, is via the credit institutions that extend financing to the agri-sector. 34% of **Banco do Brasil's** loan portfolio is to the Brazilian agricultural sector (where it has a 60% market share). Higher agricultural prices underpin future loan growth and lower provisioning requirements through the boost to credit quality. In addition, the better Brazilian macro position (we estimate that a 20% rise in crop prices improves the current account by 1% of GDP) implies falling interest rates. By the end of 2008, we expect the benchmark Selic rate in Brazil to have fallen another 150 bps to 9.75%. Another beneficiary is likely to be **Banrisul** (9% of loans to the agri-sector).

- Food processors and other price-takers of grain look less likely to outperform in this scenario. Rising input costs look set to continue to put pressure on margins, especially for those producers with greater exposure to less branded and more commoditised products. This underpins Credit Suisse's Underperform ratings on **Northern Foods, Cadbury** and **Del Monte**. This is also backed up by the fact that food producers in Europe are trading on a P/E relative that is close to extremes and are discounting no fade CFROI®s (on a Credit Suisse HOLT analysis), despite all time highs on CFROI®.

- Rapid food price inflation is problematic for food retailers (especially in areas of fierce competition, such as France). On average, only about 20% of the value of an individual food item purchased at the supermarket is directly due to commodity pricing (also known as farm value). The vast majority of expenses continue to be related to 'marketing' expenses, specifically labour, packaging, and transportation. However, with the proliferation of non-traditional formats in the food retail landscape (super-centres, wholesale clubs, dollar stores and Tesco's imminent launch in the US), pricing power has rapidly eroded as supermarkets have been forced to lower prices in an attempt to maintain traffic. We note that the food retailers have typically outperformed the market during past economic downturns, but, with food inflation weighing on margins, we continue to rate the sector market weight.

- Stock performance in the biofuel sector has been dismal this year as margins have been compressed by higher input costs (corn prices) and relatively poor output prices (ethanol). At current price levels of ethanol (US$1.70 a gallon) and corn (US$3.50 per bushel) ethanol production is uneconomic. The earnings environment for the sector, therefore, remains fairly challenging. However, two factors offer scope for some optimism: (a) ethanol relative to gasoline prices should recover as ethanol distribution channels improve and (b) capacity shutdowns and expansion delays improve the outlook for the low-cost incumbents (such as the Brazilians).

- Meat and dairy producers are similarly at risk from rising input (e.g. feed) costs. Emerging market stocks, where volume growth is stronger and margin resilience higher, could benefit from this environment. Since many developing countries lack modern transportation infrastructure for shipping food (particularly meat, which must be kept refrigerated), most of the expanded production of livestock and feed grains to feed the relatively strong demand growth of their populations will have to be close to home. Accordingly, the FAO expects developing countries to account for an increasing share of world livestock production—63% of meat production by 2030 (up from 51% in the mid-1990s) and 54% of milk production (up from 36%). Companies exposed to this theme include **Rainbow Chicken** (Not Rated) and **Astral Foods** in South Africa, **Sadia** in Brazil and the Hong Kong-listed dairy producer, **China Mengniu**.

- Growth in the use of animal genetics has been significant in the past decade and, despite concerns over the acute concentration of gene stock, the pressure to improve yields suggests plenty of further growth potential. Listed providers include **Tyson** (US), **Genus plc** (UK), **Monsanto** (US) and **Nutreco** (Netherlands), which are not covered by Credit Suisse.

- Investment in agricultural productivity is likely to increase. This includes infrastructure, seeds, fertiliser, equipment and irrigation. These investments will differ, however, depending on the circumstances in each country. Infrastructure investment is a priority in Brazil, where poor road and rail networks are clearly hampering agricultural export growth (only 10% of Brazilian roads are paved). The recently announced government-sponsored infrastructure programme (R58bn over three years) should go some way to addressing the problem. **ALL (America Latina Logistica)** is a potential beneficiary via its position as a key provider of transportation services in Argentina and Brazil (agricultural commodities correspond to around 70% of ALL's railway volumes).

- Efficient irrigation can improve crop yields by 10–30%, according to the UN. Only 2.8% of arable land in China and 1.6% in India uses efficient irrigation techniques, compared with 100% of arable land in Germany and Israel. Listed stocks exposed to this theme include **Jain Irrigation** in India and **Xinjiang Tianye Water Saving Systems** in China, which are not covered by Credit Suisse.

- Global fertiliser demand has revived in the past 12 months on the back of rising agri-prices and better farm profits. Aggregate demand should remain fairly robust but growth rates look likely to differ substantially between regions. The Food and Agriculture Organization (FAO) suggests that fertiliser tends to be substantially under-used in Africa and parts of the Caribbean and Central America but over-used pretty much everywhere else (particularly in Asia). Fertiliser use (in kilograms per hectare) is 1.5 times higher in Asia than it is in the US. In many of the larger markets fertiliser use has declined in the past five years—in Europe and China, for instance, it has fallen by 8.5% and 1.3%, respectively. Indeed, the EU Water Framework Directive (October 2000) indirectly prohibits greater use of fertilisers. The problems are two-fold: (a) fertilisers are a major pollutant of water supplies and (b) recent academic studies have highlighted that nitrous oxide, released from the nitrogen contained in fertilisers, is 296 times more potent than carbon dioxide as a greenhouse gas. Over-use of fertilisers could seriously undermine the environmental arguments for substituting fossil fuels with biofuels. From a top-down perspective, we would look at stocks that are exposed to areas of currently low (or relatively low) fertiliser use or where acreage is expanding rapidly. South African-listed **Omnia Holdings** (Not Rated) is exposed to the fast-growing African markets. Currently, sub-Saharan African use of fertilisers is just 13% of global average. **Bunge's** fertiliser division (which includes a majority stake in **Fosfertil**) and **Heringer** are the two largest fertiliser providers in Brazil. Our top picks in the US are **Agrium** and **Mosaic**. Agrium offers a good balance between nitrogen, phosphate and potash, a strong operating record, substantial exposure to retail distribution and specialty fertiliser products (such as controlled-release nitrogen, which is one way to mitigate the negative environmental impact of over-using fertilisers). Elsewhere, we find the valuations too rich for the respective growth prospects. Credit Suisse rates **Sinofert** (China based) and **K+S** (Germany) Underperform.

- Genetically modified seeds could perhaps be the single most important driver of agricultural productivity, especially if Monsanto or DuPont improves drought-resistant technology. Monsanto claims that the combination of biotechnology and breeding techniques can double corn yields to 300 bushels per acre by 2030. The GM seed market has seen massive growth over the past 10 years. Despite a range of potentially negative side effects to the environment, the yield enhancement of GM crops looks attractive (between 5% and 40% depending on the crop and the region). In 1996, the ISAAA estimated that 1.7m hectares globally were dedicated to GM crops in just six countries—by 2006, this had increased to over 102m hectares across 22 countries with a value of US$6.2bn in sales. However, this still represents only 6.6% of total global agricultural acreage. Growth projections suggest a doubling in GM dedicated acreage by 2015. An additional 29 countries have already granted regulatory approval for biotech crops as imports for food use and feed for livestock. Biofuel demand and development of drought-resistant strains are likely to be catalysts for further growth in GM production. The main providers are **Monsanto, DuPont, Syngenta** and **Bayer**, which are not covered by Credit Suisse.

- Rising farm profitability is likely to spur stronger sales in equipment (new and replacement). Relative farm size (less than one acre on average in China) means that it is very unlikely that tractor and machinery usage will grow to anywhere near the ratios of the US (where the USDA 2002 Agriculture Census showed that the average farm size in the US was 441 acres, or 179 hectares). That said, there is still a wide gulf between machinery usage in developed markets compared with that in the emerging markets. In Brazil, where farms are an average 67 hectares, there is only one tractor to every 83 hectares. The EU-15 has an average farm size of just 19 hectares, yet there is one tractor to every 28 hectares. Global manufacturers (such as **Deere**) look well positioned to benefit from the trend, although we are more cautious about companies such as **Kubota**, which have greater relative sales to home-owners (garden machinery) than to the industrial agricultural sector.

- The direction of global farm subsidies going forward is unclear. Global trade will need to increase to maximise each country's comparative advantage. However, despite little advance in reducing trade barriers over the past decade, Brazil and Argentina appear to be gaining market share in global agricultural markets at the expense of France and Australia. Brazil and Argentina both have large areas of flat land with regular rainfall, relatively long growing seasons, and soil that can retain fertiliser. Despite all the transport and logistical problems, their share of total agricultural exports has increased—from 4.4% and 2.8% in 1985 for Brazil and Argentina, respectively to 5.5% and 3.8%, respectively in 2004. This trend looks set to continue (and if anything accelerate) given the focus on increasing biofuel use, in which Brazil offers a significant comparative advantage. Listed shipping companies exposed to growth in agricultural trade include **Eitzen, Odjfell** and **Stolt-Nielsen**, which are not covered by Credit Suisse. **ADM, Bunge** and **Cargill** (a private company but with debt offerings) could benefit as well because they store and transport grain.

Stock picks

The Credit Suisse Top 20 picks on higher agricultural prices

We are highlighting 20 stocks that (a) we expect to be beneficiaries of the forecast rise in agricultural prices, (b) screen well on Credit Suisse HOLT and our composite valuation screen and/or (c) are Outperform or Neutral rated by Credit Suisse/Credit Suisse Standard Securities analysts.

The 20 stocks are presented in Figure 1. The list is sorted by the final column (the aggregate score), which combines the results of the most attractive valuations (based on consensus P/E, P/BV, yield and Credit Suisse HOLT), the best momentum (on CFROI®, earnings and sales) and the most *negative* sentiment (i.e. stocks with a greater number of broker sell ratings rank more highly).

Figure 1: **Credit Suisse Top 20 picks on higher agricultural prices**

				-----P/E (12m fwd) ------			------ P/B -------		Yield (07)		HOLT			---------- Momentum -------------							
Name	Sector	Main Mkt Cap listing (US$mn)		Abs	rel to Industry	rel to mkt % above/below average	Abs	rel to mkt % above/below average	FCY	DY	Implied CFROI less 5-year average	Price, % change to best	Valuation score	CFROI	1m EPS	3m EPS	3m Sales	Momentum score	Consensus (buy less holds & sells)	Overall score	Credit Suisse rating
Indofood Agri	Food Products	SG	1,375	12.0	72%	86%	1.7	-35%	n/a	n/a	n/a	n/a	4.0	6.0	4.3	6.3	4.5	2.0	100.0	6.0	Outperform
BrasilAgro	Food Products	BZ	405	n/a	n/a	n/a	1.3	-7%	n/a	n/a	n/a	n/a	3.0	n/a	n/a	n/a	n/a	1.0	0.0	5.0	Outperform
Kellogg Co	Food Products	US	21,486	18.1	101%	10%	9.0	-16%	4.8%	2.3%	-2.1	-13.5	3.0	-1.7	0.1	0.2	0.8	1.5	26.3	4.5	Outperform
Bco Do Brasil Sa	Banks	BZ	12,820	10.9	104%	82%	3.5	n/a	n/m	1.0%	-2.4	24.1	3.0	-1.0	3.1	1.5	NM	1.3	33.3	4.3	Outperform
Illovo Sugar	Food Products	SA	1,233	13.6	76%	93%	4.5	51%	4.9%	3.2%	2.3	-9.9	2.0	-0.5	0.0	0.2	NM	0.7	-60.0	3.7	Outperform
London Sumatra	Food Products	ID	976	15.9	89%	139%	n/a	n/a	n/a	0.8%	0.6	11.5	3.0	n/a	0.0	-2.0	1.4	0.7	50.0	3.7	Outperform
Agrium Inc	Fertilizers	JP	7,395	13.9	83%	77%	5.2	112%	1.6%	0.2%	4.3	-12.9	1.0	2.8	-0.7	9.0	1.5	1.5	-11.1	3.5	Outperform
ALL	Capital Goods	BZ	8,563	35.5	161%	277%	n/a	n/a	0.8%	0.7%	n/a	n/a	1.0	1.5	2.3	4.3	4.5	2.0	100.0	3.0	Outperform
SLC Agricola	Food Products	BZ	856	23.8	135%	176%	n/a	n/a	n/a	1.0%	n/a	n/a	1.0	n/a	3.4	8.0	8.5	2.0	50.0	3.0	Outperform
Wrigley (Wm) Jr Co	Food Products	US	18,893	24.8	139%	16%	6.8	-11%	2.7%	1.9%	0.4	-21.3	1.0	-0.5	-0.2	0.4	1.9	1.0	-38.5	3.0	Neutral
Bunge Ltd	Food Products	US	12,933	20.2	113%	88%	2.5	46%	2.0%	0.6%	1.6	-21.4	0.0	0.6	12.2	21.1	29.7	2.0	-40.0	3.0	Outperform
Agco Corp	Machinery	US	4,644	20.7	135%	130%	3.1	80%	n/a	0.0%	n/a	n/a	0.0	n/a	1.1	7.3	3.8	2.0	-45.5	3.0	Neutral
Deere & Co	Machinery	US	31,959	15.5	101%	25%	4.0	43%	4.5%	1.4%	2.8	3.5	1.0	1.1	0.1	9.8	0.7	2.0	11.1	3.0	Outperform
China Mengniu Dairy	Food Products	HK	6,503	37.5	210%	105%	9.7	93%	-0.1%	0.3%	-0.3	-23.5	1.0	-0.2	0.7	6.6	0.8	1.5	66.7	2.5	Outperform
Sadia Sa	Food Products	BZ	4,359	15.6	87%	178%	3.1	129%	-3.4%	1.9%	3.9	-63.7	1.0	-3.3	4.8	9.1	5.6	1.5	0.0	2.5	Neutral
Mosaic Co	Fertilizers	US	27,769	20.4	122%	n/a	7.3	n/a	1.3%	0.0%	12.6	-34.9	0.0	10.9	14.8	40.2	15.0	2.0	11.1	2.0	Outperform
Astra Agro Lestari	Food Products	ID	3,240	18.5	104%	168%	11.3	339%	1.2%	1.9%	9.1	-38.1	0.0	6.6	0.2	6.2	2.3	2.0	37.5	2.0	Outperform
Sime Darby Bhd	Industrial Conglomerates	MY	8,416	22.7	139%	50%	2.8	10%	2.5%	2.1%	2.6	-26.5	0.0	0.6	0.0	1.0	1.5	1.5	20.0	1.5	Outperform
Kuala Lumpur Kepong	Food Products	MY	4,545	19.3	108%	29%	3.5	91%	0.7%	0.8%	6.4	-23.2	0.0	3.0	-0.6	-9.5	4.2	1.0	23.8	1.0	Outperform
Ioi Corp	Food Products	MY	11,787	24.2	135%	n/a	21.0	n/a	1.3%	1.1%	4.3	-28.0	0.0	2.1	0.0	-0.9	0.3	1.0	10.0	1.0	Outperform

Note: Ilovo Sugar is covered by Credit Suisse Standard Securities (analyst: Brendan Grundlingh), a joint venture involving Credit Suisse.
Source: MSCI, Datastream, Factset, I/B/E/S consensus estimates, Credit Suisse HOLT, Credit Suisse research

Demand for agricultural products

We can divide our thoughts on demands on global agriculture into two parts:

1. the demand from the food chain; and
2. the (more recent and fast-growing) demand from the biofuels industry.

1: Population-driven demand

We can categorise three areas of demand growth from the population:

(a) Population growth

According to the UN, global population is currently expanding by about 75m people per annum. The growth rate is slowing, but should still be almost 60m per annum in 2030. This means that by 2030, the world will be trying to support a total population of just over eight billion people. On current consumption patterns, that would imply a required increase in agricultural output of 25% by 2030, or a CAGR of 1.1%.

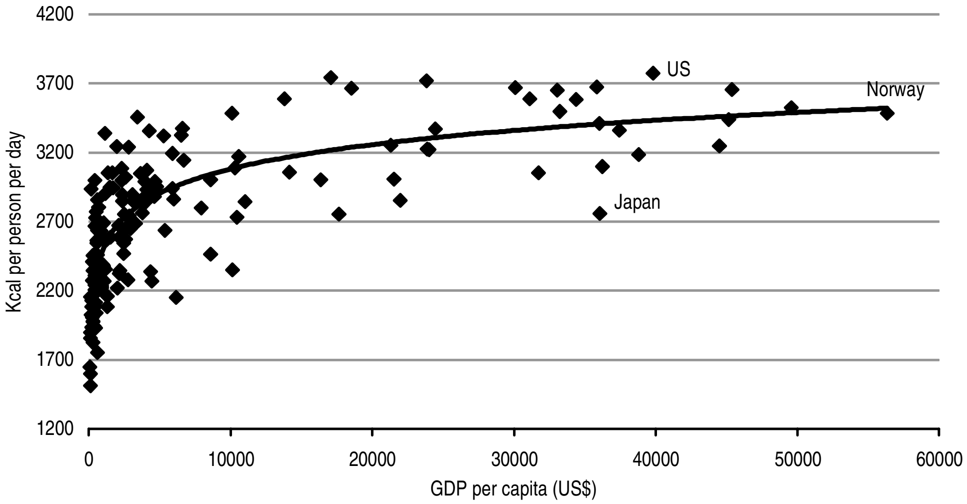
Population growth is projected to add 1.1% pa to world food demand…

(b) Calorie consumption

Moreover, people are generally consuming more. The evidence shows that as real incomes increase, so does calorie consumption per capita. In combination with the projected 25% increase in the global population, this implies a 43% required increase in food production, or CAGR of 1.5%.

…and people are consuming more, on average

Figure 2: **Calorie consumption per capita versus GDP per capita**



Source: FAO, IMF, Credit Suisse research

Growth in calorie consumption is much stronger as real incomes move away from very low levels of GDP per capita. Calorie consumption is largely insensitive to changes in higher relative levels of income per capita.

Since 1990, per capita GDP has been growing faster in developing countries than in developed countries and in the period 2001–06, developing countries averaged 6.4% compared with 2.5% for the developed countries. If this trend persists (on average) for the next 25 years, then average GDP per capita for developing countries (5.2bn people) would rise from US$1,500 per head currently to cUS$6,500 per head, taking calorie consumption per head up by c19%.

If the trend in calorie consumption persists, there could be 19% growth per person over the next 25 years

Calorie consumption per capita is currently rising most quickly in Africa (it is up 8% in Angola in the past five years and 9% in Mozambique, Ghana and Namibia).

(c) Changing diets

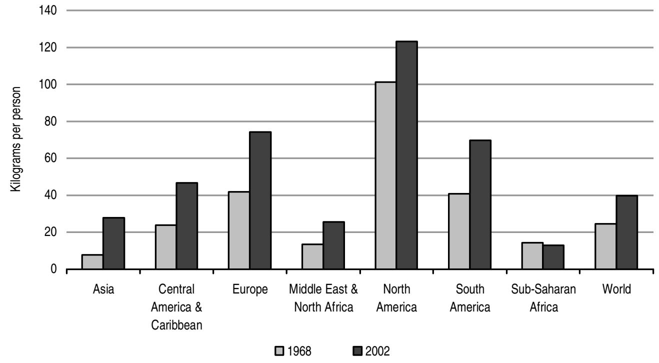
Increasing real incomes and urbanisation in developing countries are encouraging higher levels of nutrition and diets more closely resembling those of industrialised countries.

Over the past few decades, consumption of meat in developing countries has grown at a rate of 5–6% per year; consumption of milk and dairy products at 3–4%. Poultry is the fastest-growing sector worldwide: it represented 13% of the meat production in the 1960s, compared with 28% currently. Poultry is the most efficient means of converting grain into protein in the protein industry.

Meat consumption in developing countries is growing nearly 10 times faster than that in industrialised countries

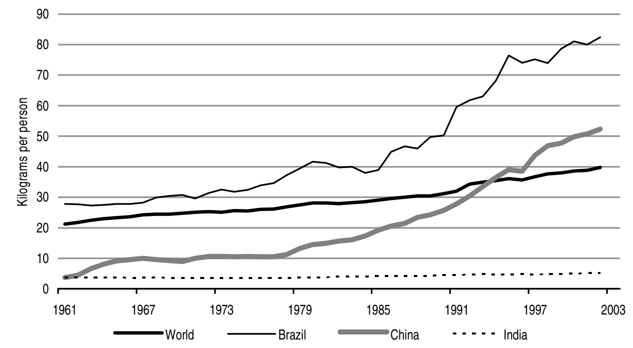
Meat consumption in developing countries is growing nearly 10 times faster than that in industrialised countries (4.8% vs 0.5% annualised growth over the past 10 years), but citizens of developing countries still eat two-thirds less meat.

Figure 3: **Regional meat consumption per capita**



Source: FAO

Figure 4: **Meat consumption per capita**



Source: FAO

However, much of the current growth in meat demand in the developing world is taking place in a few large nations, especially China and Brazil, which have accounted for more than half the increase in per capita meat consumption in developing nations since the 1970s. In the past decade alone, meat consumption in China has been rising at an average of 2kg per capita per year. This rate of growth now looks to be slowing, albeit from a very high base.

There are three implications of this rise in demand for meat:

(i) **Global grain production**: the FAO estimates that global grain production, currently 2.22bn tons per annum, will need to increase by 40% to meet demand (for human and livestock consumption) in 2020 (this is a CAGR of 2.4%). Incorporating the rise in population and calorie consumption, and the shift in dietary requirements, the UN forecasts that a 67% increase in food production is necessary for developing countries by 2030.

One caveat here is that feed conversion rates (through the use of selective breeding and different types of food) have improved markedly and are likely to continue to improve. Feed conversion rates for chicken have improved from close to 4:1 40 years ago, to less than 2:1 now.

(ii) **Water demand**: According to the United Nations Environment Programme (UNEP), the amount of water required to produce meat (especially beef) is much greater than the equivalent weight of cereals.

Figure 5: Water requirement equivalent of main food products

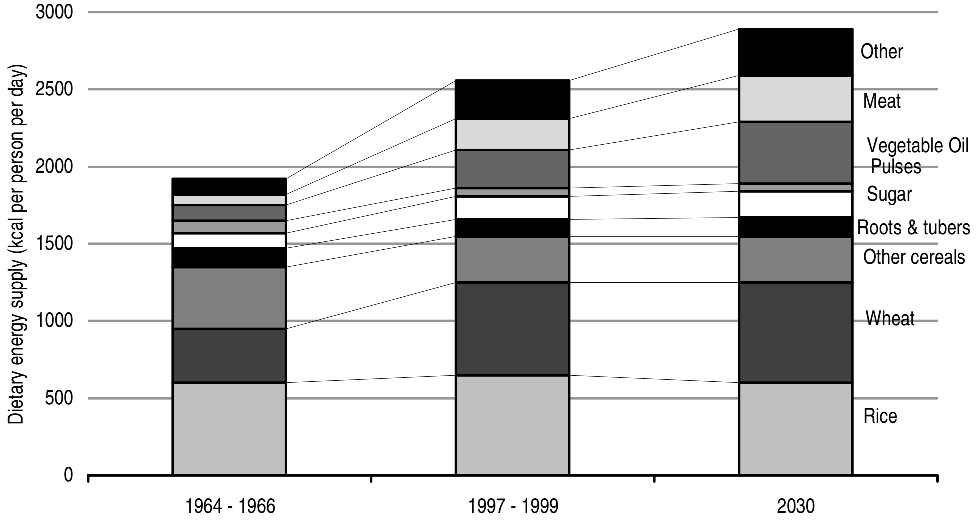
Product	Unit	Equivalent water in M^3 per unit
Cattle	Head	4,000
Sheep and goats	Head	500
Fresh beef	Kg	15
Fresh lamb	Kg	10
Fresh poultry	Kg	6
Cereals	Kg	1.5
Citrus fruits	Kg	1
Palm oil	Kg	2
Puls**es**, roots and tubers	Kg	1

Source: UNEP, Extracted from the Executive Summary of the 1st World Water Development Report (2003)

Producing a kilogram of beef requires 10 times the water input as a kilogram of cereals

We estimate that the FAO's projections for dietary changes in food consumption imply more than double the water usage in food production.

Figure 6: Dietary changes in developing countries (1965–2030E)



Water equivalent in M3 per person per day	1.44m3	2.49m3	3.15m3

Source: FAO 2003, Credit Suisse estimates

While rice, wheat and other cereals remain the main component of the human diet, their relative weight tends to decline as income rises, mitigated by a rise in consumption of meat and vegetable oils

Given growing water shortages for key agricultural producers (Australia, parts of the US, India and China) this presents another hurdle in the hunt for higher yields.

(iii) **Home grown**: Since many developing countries lack modern transportation infrastructure for shipping food (particularly meat, which must be kept refrigerated), most of the expanded production of livestock and feed grains to feed their populations will have to be close to home. Accordingly, the FAO expects developing countries to account for an increasing share of world livestock production—63% of meat production by 2030 (up from 51% in the mid-1990s) and 54% of milk production (up from 36%).

2: The biofuels demand shock

Rising oil prices and issues over the security of oil supply have meant that turning agricultural products into transportation fuel is a rapidly expanding business. The bottom line on biofuels, in our view, is that capacity has been built and must continue to be built if government targets are to be met. Credit Suisse's US food team estimates that biofuel demand will add 80 bps per annum to global food demand for the next five to eight years. Combining growing demand for food with this biofuel demand, we anticipate that global supply needs to rise by 3.3% per annum over the medium term. Appendix 1 contains the full details of how we calculate that biofuels will add 80 bps to global food demand.

We estimate biofuel demand will add 80 bps pa to global food demand for the next five to eight years

There are currently two main types of biofuels: biodiesel and bioethanol.

- Bioethanol (ethanol) comes from the distillation of starch and sugars into a pure ethyl alcohol, which is typically blended into the conventional gasoline pool (although it can function directly in modified engines). The US and Brazil dominate the ethanol industry, accounting for c90% of global production.
- Biodiesel comes from the chemical reaction of vegetable or animal fats with alcohol to produce a vehicle-ready diesel fuel, again normally blended into the conventional diesel pool, although it can be used neat in existing diesel engines. Biodiesel is currently a much smaller industry than bioethanol and is dominated by Europe (which currently accounts for 80% of global supply and demand).

Legislation in key regions implies significant percentages of arable land (*ceteris paribus*) would need to be dedicated to producing the feedstock used for biofuels.

Figure 7: **Biofuel production and targets**

	Current biofuels as % gasoline consumption (A)	Current acreage potentially used for biofuel production (B)	Target (C)	Main biofuel crops (D)	Gallons of ethanol/bio diesel from one acre (E)	Arable acres (m) (F)	Total gasoline consumption bn gallons p.a. (G)	Required acreage to meet target (m) (H)	% of total arable acreage (I)
Europe (ethanol)	0.7%	0.34%	10% biofuels by 2020 in all member states	Grains	150	---	54	36	5%
Europe (biodiesel)	1.5%	1.42%		Rapeseed	80	743	56	70	9%
Australia	<1%	0.23%	5% by 2011	Corn/wheat	150	118	5	2	1%
US	3.5%	5.65%	20% by 2017	Corn	180-300	434	126	84-140	19 - 32%
Canada	>1%	0.42%	Intends all gasoline to contain minimum 5% ethanol by 2010	Corn/wheat	150	129	10	3	3%
China	<1%	0.18%	15m tons of bioethanol by 2020	Grains	150	383	13	12	3%
Japan	<1%	3.53%	500m litres (132 mn gallons) by 2010	Grains and sugar-cane	180	12	15	0.7	6%
Brazil	13.7%	0.58%	Mandated 20-25% ethanol in all gasoline	Sugar-cane	800	165	5	2	1%
Total		**2.04%**				**1984**		**238**	**12%**

Source: FAO, WRI, Credit Suisse estimates

(B) Indicative figures only as assumes all biofuel feedstock is sourced domestically rather than from imports

(F) Arable acres defined as all arable and permanent cropland including acreage planted with cereals, rubber, coffee, tea, vines and orchards as well as fallow land not planted within the last 5 years. Sourced from the FAO database.

(G) Motor gasoline/diesel consumption only. Sourced from the World Resources Institute

(H) Required acreage to meet the biofuel target s calculated on prevailing yields (i.e. column D). This assumes that all of the ethanol will come from first generation corn ethanol. In fact, as President Bush mentioned in the State of the Union speech, there is a general assumption that second generation or cellulosic ethanol will need to play some part if these targets are to be met.

Take the US, for example. Currently, biofuels make up just 3.5% of total gasoline consumption. In his State of the Union address in January 2007, President Bush set a biofuel target of 20% of total fuel consumption within the next 10 years. For the time being, some 93% of US ethanol is derived from corn, with one acre yielding between 180 to 300 gallons. 126bn gallons of gasoline per annum are currently consumed in the US, which implies that (on the current yield statistics) somewhere between 84 and 140m acres of corn will be required to meet the 20% target. This is equivalent to 19–32% of total US arable acreage. Put another way (and incorporating federal forecasts for both the expected rise in demand for fuel by 2017 and the increase in crop yields), the 35bn gallons of ethanol required to meet the 20% target will account for 40% of the forecast US annual corn harvest by 2017 (up from c18% currently).

Brazil sits at the opposite end of the spectrum. Besides the mandatory 20–25% blending of ethanol into gasoline, consumption of pure ethanol has been increasing with the expansion of the flex-fuel fleet in the country (cars that can run on both gasoline or pure ethanol). Meeting this demand growth, within the country, should not be an issue given the much higher ethanol output yielded from sugarcane (more than 800 gallons per acre).

Figure 7 aggregates the respective biofuel targets around the world. The most aggressive is the US's target, followed by the EU's. We calculate that the combined impact of these targets commits 238m acres or 12% of total global arable and permanent cropland to biofuel feedstock production.

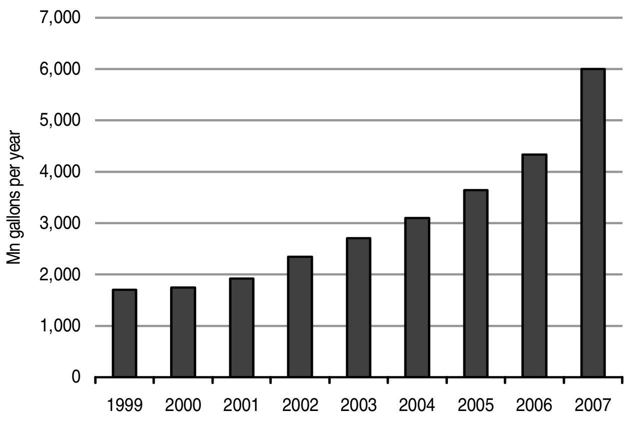
On our estimates, government targets commit 12% of total arable land to biofuels

The key developments in the biofuel industry are:

(a) Legislation has already been passed, as noted in Figure 7.

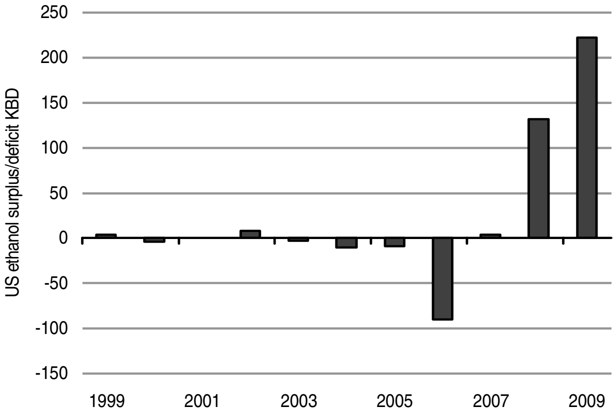
(b) There has been a huge expansion in ethanol capacity (particularly in the US where production capacity has doubled in the last three years)...

Figure 8: US Ethanol production capacity



Source: DOE, RFA

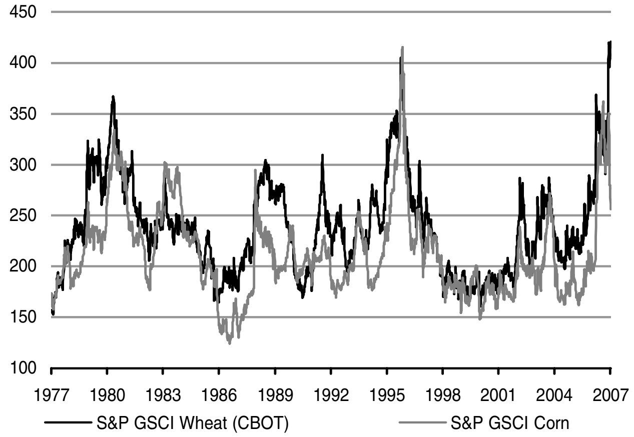
Figure 9: US Ethanol balance (static market share)



Source: Credit Suisse estimates

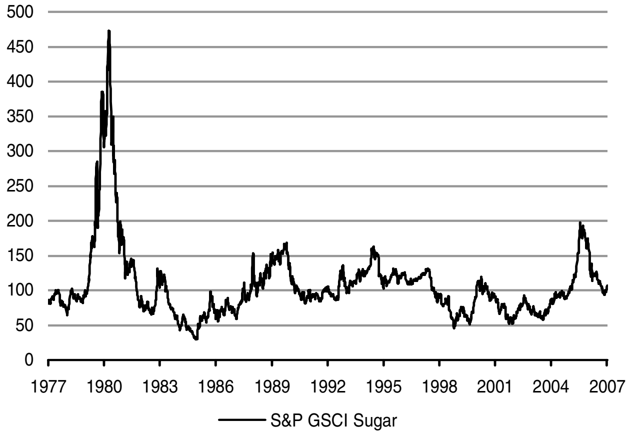
(c) …which has driven up the price of some of the feedstocks (corn and wheat) to new highs.

Figure 10: Corn and wheat prices



Source: Bloomberg

Figure 11: Sugar prices

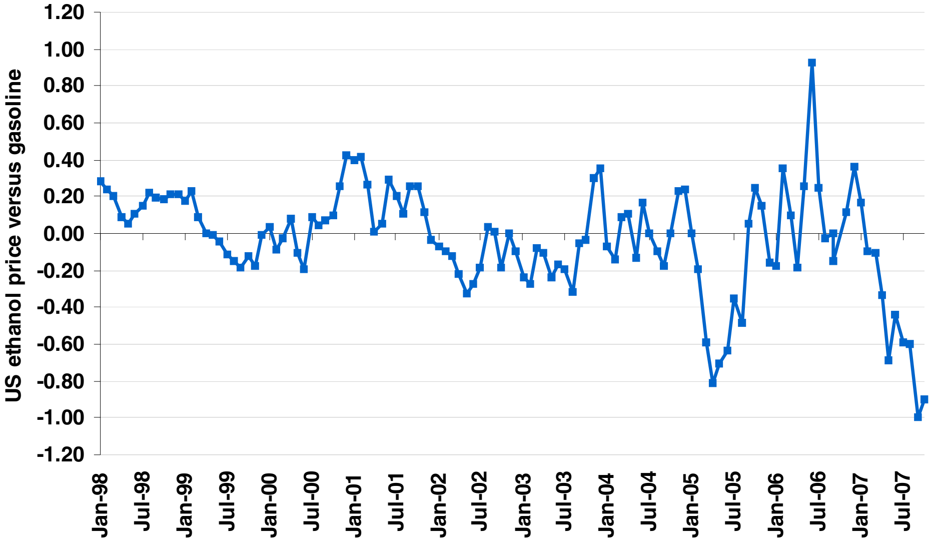


Source: Bloomberg

(d) However, the rapid increase in ethanol production, in conjunction with a squeeze on distribution inventory, has resulted in a glut of ethanol on the market. As a result, wholesale prices of ethanol have dropped to US$1.70/gallon and ethanol is now trading at close to a US$1.00/gallon discount to gasoline when factoring in the US$0.51/gallon federal tax credit for blenders who use ethanol. We expect the ethanol glut to persist for a while longer.

Figure 12: **Ethanol price versus gasoline price (includes 51¢ tax credit)**

Ethanol prices have significantly underperformed gasoline prices

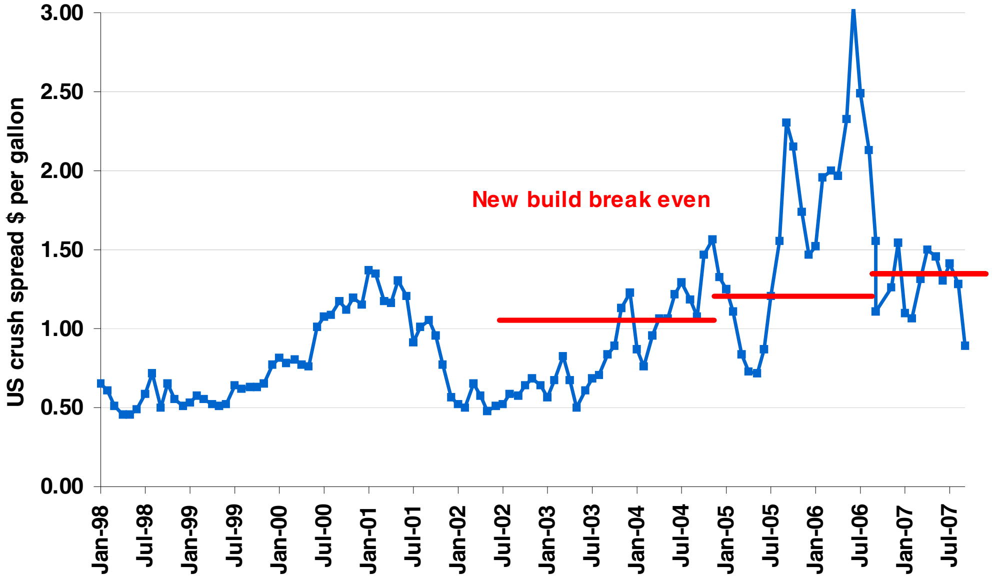


Source: Bloomberg, Credit Suisse research

At current prices, the economics for new-build ethanol wet mills do not make sense, in our view. It is not surprising, therefore, that plans for new capacity have been significantly scaled back, particularly in the US. The key criteria in determining to a new-build ethanol plant are the cost of the corn input and the price of the ethanol output. The level of crude oil is important, as it sets a floor for gasoline prices but, as shown above, the relationship between ethanol prices and gasoline has recently undergone some wild swings. The ethanol industry is a very small part of the conventional fuels market and is unable to influence a pass-through of corn costs to blenders.

At current prices, the economics for new-build ethanol wet mills do not make sense, in our view

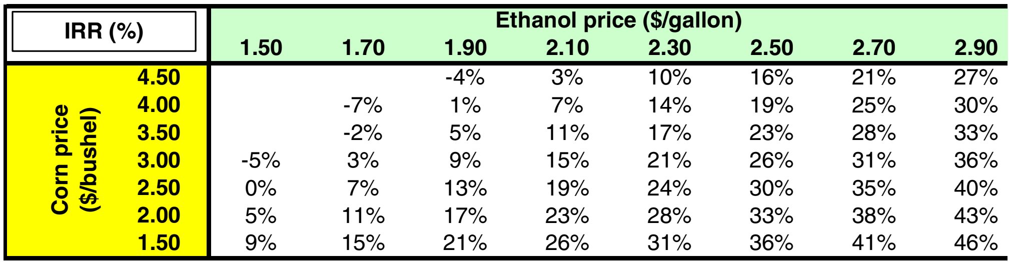
Figure 13: **Break-even levels of crush spread for new-build ethanol plants**



Source: Bloomberg, Credit Suisse research

In the sensitivity analysis presented in Figure 14, we illustrate that with ethanol prices at US$1.70 (where they are now) the producers are generating negative returns at US$3.50 per bushel of corn.

Figure 14: **New build economics for a US Ethanol plant (various corn prices)**



IRR (%)		Ethanol price ($/gallon)							
		1.50	1.70	1.90	2.10	2.30	2.50	2.70	2.90
Corn price ($/bushel)	4.50			-4%	3%	10%	16%	21%	27%
	4.00		-7%	1%	7%	14%	19%	25%	30%
	3.50		-2%	5%	11%	17%	23%	28%	33%
	3.00	-5%	3%	9%	15%	21%	26%	31%	36%
	2.50	0%	7%	13%	19%	24%	30%	35%	40%
	2.00	5%	11%	17%	23%	28%	33%	38%	43%
	1.50	9%	15%	21%	26%	31%	36%	41%	46%

Note: assumes construction cost per annual gallon of $2.10 per gallon.

Source: Credit Suisse estimates

What next? Despite the short-term glut in ethanol, ethanol producers we speak to generally operate under the assumption that corn production will increase sufficiently and that their ethanol blending customers will eventually invest in the infrastructure necessary to ensure ethanol can be distributed into the US gasoline pool. There is already evidence that two big new markets, Florida and Georgia, will open up via rule changes in early 2008, and we are also seeing independent retailers seeking to blend ethanol due to the overwhelmingly attractive economics from the steep ethanol discount to conventional gasoline. The bottom line is that we expect the price of ethanol relative to gasoline to recover over the next year.

European ethanol production has not increased

(e) European ethanol production has not increased. European gasoline demand is falling, so refiners are already exporting conventional gasoline from Europe and have little incentive to invest in new capacity. In addition, the relative price of the bulk of European feedstock (wheat or rye) is considerably more expensive than the US or Brazilian equivalent and yields are lower per acre. The investment decision in Europe is even more unfavourable than in the US.

The next generation in biofuel production is the use of non-food parts of the plant, but this may not be commercially viable for some time

(f) The crop conundrum is eased if yields can increase or ethanol be provided by non-food parts of the plant. Cellulosic ethanol is the conversion of plant materials (wheat straw, switchgrass or corn stover/stalks, for instance) into ethanol. This could potentially mean much greater production from an acre of corn as the whole of the plant, rather than just part of it, could be used in the process. Alternatively, farmers could plant acres of switchgrass on less viable land and just process the grass. However, cellulosic ethanol is unlikely to be commercially viable for some time. According to the *MIT Technology Review* (February 2007) only demonstration facilities are planned for completion in 2008. Cellulosic production would also require far-reaching changes in the corn industry's infrastructure, because hundreds of small processing facilities would need to be constructed and located near the cellulosic material. The cost of transporting low-value cellulosic materials in bulk is currently prohibitive compared with higher-value bulk options. Farmers would also have to be willing to sell their corn stover to processors instead of leaving it on the ground, a practice that encourages topsoil growth and increases yield in the next crop season.

Brazil is by far the lowest-cost ethanol producer

(g) Brazil is the lowest-cost ethanol producer (with yields of c800 gallons per acre). However, logistical problems are hampering trade, a topic that we discuss in more detail in the next section on agricultural supply. The US, meanwhile, continues to levy a US$0.54/gallon tariff on imported ethanol.

Biodiesel growth is relatively strong in parts of Asia and Europe

(h) Biodiesel growth is relatively strong in parts of Asia and Europe. European gasoline demand is falling but demand for more efficient (in terms of MPG) diesel cars is still on the increase. Diesel cars now make up nearly 35% of all vehicles in Europe. However, given the lack of a co-ordinated policy approach, we think there is the risk of over-supply of biodiesel in some parts (this has already happened in Germany, for example, which has depressed the relative price of biodiesel there).

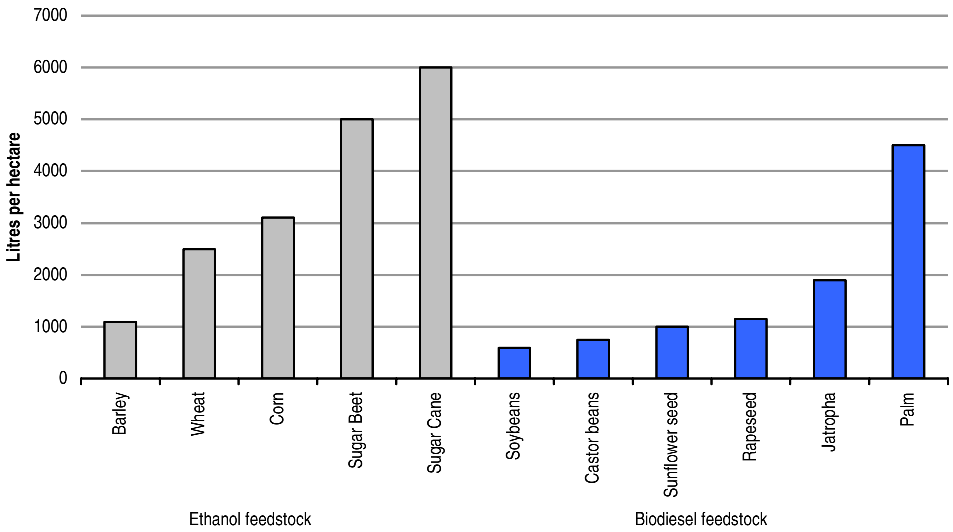
Rising food prices have prompted some back-tracking on government biofuel targets, but we think it unlikely that this will happen in the EU or US

(i) The additional pressure that biofuel demand has placed on food prices has led to some back-tracking on government biofuel targets (as has been the case in China recently) and protectionist measures to limit the impact on the domestic market (Indonesia, for instance, just raised to 10% its export tariff on palm oil in order to cool domestic prices). We think it unlikely that biofuel targets set by either the US or EU will be altered substantially in the next five years for three main reasons: (1) the loss of political face this could incur given the high-profile nature of the targets; (2) a continuing desire to reduce reliance on Middle Eastern oil supplies and; (3) the strength of the farming lobby, which is clearly benefiting from the higher agricultural prices, and the commensurately lower government farming subsidies as agri-prices have risen.

(j) There is a wider debate as to whether biofuels really are environmentally friendly. A recent report published in the *Atmospheric Chemistry and Physics* journal postulated that the Nitrogen fertiliser consumed in the production of biofuels released excessive levels of nitrous oxide (296 times more potent as a greenhouse gas than the carbon dioxide emissions that biofuels are designed to offset). The report concluded that for rapeseed biodiesel the relative warming due to N2O emissions is estimated at 1 to 1.7 times larger than the cooling effect due to saved fossil CO2 emissions. For corn bioethanol the figure is 0.9 to 1.5. Only cane sugar bioethanol, with a relative warming of 0.5 to 0.9, looks like a viable alternative to conventional fuels.

Ultimately, however, this is an argument against the use of fertilisers rather than against the biofuel concept. Other academic studies have focused on the relative merits of certain crops in the production of ethanol and biodiesel. It is largely accepted that sugarcane is currently the most effective method of producing ethanol, followed by corn, and that palm oil is the most effective way of producing biodiesel.

Figure 15: **Yield per hectare from various ethanol and biodiesel feedstocks (2006)**



Source: International Federation of Agriculture Producers

Some academic research has suggested that low-yielding crops (wheat and rapeseed production in Europe) ultimately contribute more carbon dioxide to the atmosphere than they offset through replacing fossil fuels. To the extent that this is true, at least on a relative basis, we think it could be in the global interest to shift production towards the areas of comparative advantage, i.e. South America rather than Europe.

Demand: Summary

We anticipate that global food and biofuels add 3.3% growth per annum to aggregate demand over the medium term. This demand can be broadly broken down into:

1. Growth in the global population (projected eight billion people by 2030) equal to 1.1% growth per annum.
2. Increased calorific intake and shift in dietary trends (greater meat consumption), especially within emerging markets, which in conjunction with the increased number of people, implies required growth in food production of c2.5% per annum.
3. Biofuels expansion is a new element in the demand for agricultural produce that we think will increase demand growth by 80 bps over the next five to eight years.

But can supply keep pace?

Supply of agricultural products

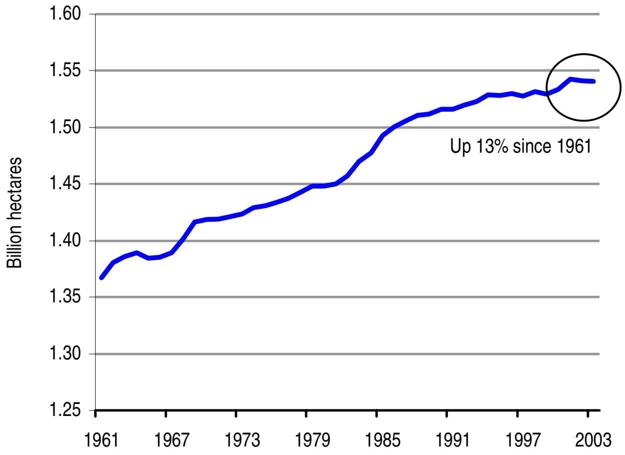
We suggest the supply of food and biofuel feedstock can be looked at under two headings:

- Firstly, there is a simple measure of the acreage under cultivation and how that might change.
- Secondly, there are productivity issues, be they yield per hectare or livestock genetics.

1: Acreage expansion?

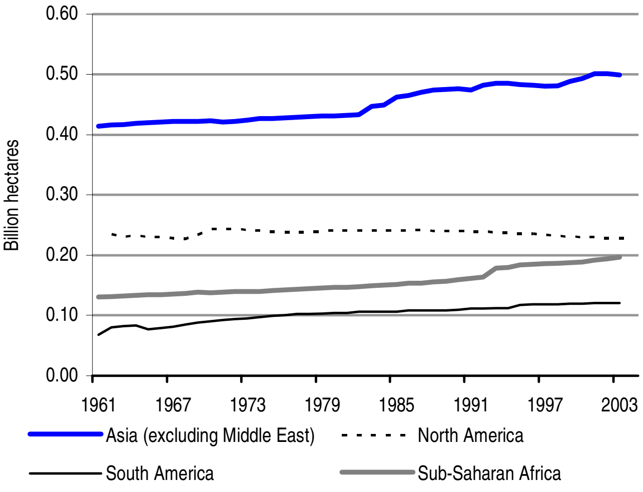
Cultivated acreage has expanded by 13% globally since 1961, according to the FAO. Most of this increase can be attributed to South America (Brazilian cropland has increased by 135% since 1961 and now accounts for 4.3% of the world's agricultural land).

Figure 16: **World total: arable and permanent cropland**



Source: FAO

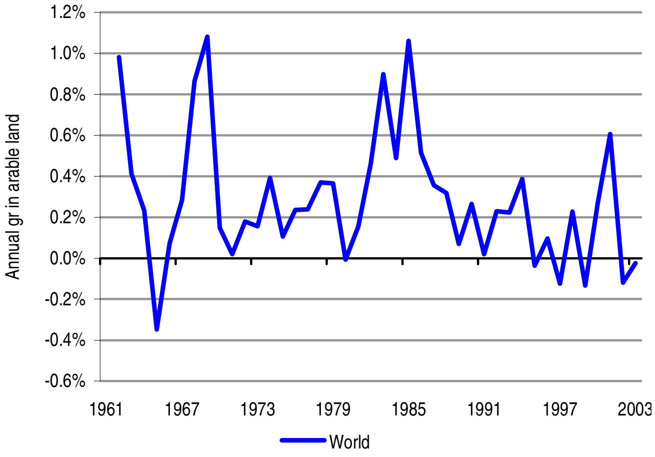
Figure 17: **Regional totals: arable and permanent cropland**



Source: FAO

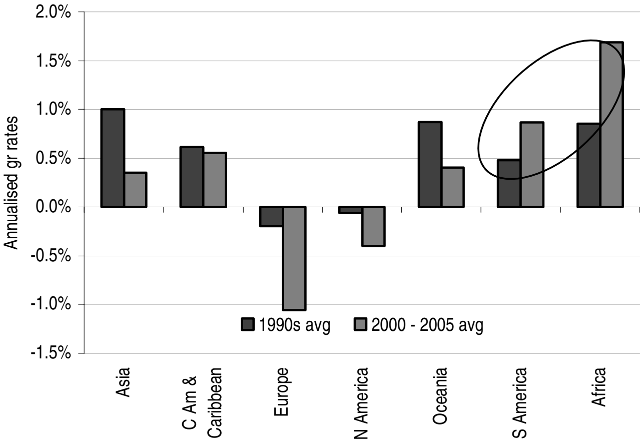
More recently, the rate of growth in arable land has slowed to close to zero on aggregate. Negative growth rates in Europe and North America have been offset by expansion in Africa and South America.

Figure 18: **Global arable land (% change y/y)**



Source: FAO

Figure 19: **Regional growth rates in arable land**



Source: FAO

Soil quality, the length of the growing season and rainfall are the biggest drivers of agricultural productivity and therefore the biggest barriers to acreage expansion. That aside, three other factors are weighing on the expansion of arable land.

(a) Initiatives to counter deforestation

The International Energy Agency (IEA) estimates that in the 1990s, the carbon dioxide released as a result of deforestation averaged 1.6 GtC per annum and accounted for 20% of the total rise in CO2 concentration in the atmosphere. With this backdrop, various environmental initiatives (including Kyoto and the Intergovernmental Panel on Climate Change (IPCC) have called for a complete reversal and shift to *reforestation.*

Deforestation is still accelerating in less-developed, sub-tropical regions

The rate of deforestation has reversed in many of the developed markets (US, UK and Germany to name a few) but continues to accelerate in the less-developed, sub-tropical regions. For the time being, however, international policies to reduce deforestation are not in place.

- Kyoto, for instance, allows Clean Development Mechanism (CDM) credits to be earned by member countries that partner *reforestation* projects but makes no allowance for member countries that prevent deforestation. The FAO has called for inclusion of forest conservation in the next commitment period (after 2012) of the Kyoto Protocol, which could encourage tropical countries to make meaningful contributions to reducing global emissions.
- *The Wall Street Journal* recently reported (11 June 2007) that the World Bank is set to launch a US$250m fund under a pilot scheme to pay tropical countries to preserve their forests. This looks a paltry amount in the face of rising agricultural profitability, in our view.
- At the national level there are more meaningful measures in place to slow the rate of deforestation. Norway has banned the use of tropical timber in all public buildings, according to the Rainforest Foundation Norway. Under a new law signed by President Lula in March 2006, Brazilian forests can only legally be logged by authorised (domestic) contractors that adhere to a sustainable development plan. According to the Brazilian government, the scheme allows for only five or six trees to be harvested over a 10-year period across each plot (one plot equates to roughly the size of a football field). However, results have been mixed: illegal logging is an ongoing problem and with crop prices rising (including timber prices), the incentives are increasing.

(b) Urbanisation

Urbanisation is eating into agricultural land and reducing the workforce available to farm it

The average population size of the world's 100 largest cities grew from around 0.2m in 1800, to 0.7m in 1900, to 6.2m in 2000. Currently, half the world's population lives in urban centres, compared with less than 15% in 1900. By 2030, the UN forecasts that 60% of the world's population will live in urban areas.

Urbanisation has eaten into agricultural land and reduced the workforce available to farm it. In China, the contraction in agricultural workers is running at half a million a year and the amount of arable land has dropped by 6% over the past 10 years.

(c) Land degradation

The UN estimates that some 1.9bn hectares of land worldwide has been affected by land degradation. The main causes are soil erosion, loss of nutrients, damage from inappropriate farming practices and the misuse of agricultural chemicals. In the Philippines, for example, an estimated 1.2m hectares of cropland roughly—one-fourth of the total—have been severely degraded by pesticides and chemical fertilisers. The FAO estimates that weathering erodes 25bn metric tons of topsoil from the world's croplands. China's Yellow River empties 1.6bn metric tons of eroded topsoil into the Yellow Sea each year.

However, despite these factors, there are two areas where we expect to see an expansion in arable land: (i) in the US and Europe, by using set-aside land, although the potential is limited; and (ii) in South America, where the potential is much greater.

(i) In the US and Europe, farmers receive subsidies for idling land. In Europe, land is 'set-aside' in order to support European agricultural prices. Current estimates from the European Commission put the amount of set-aside at roughly 3.2m hectares (or c8% of current European arable land). As prices of crops rise, the incentives to plant improve.

'Set-aside' could be reduced in Europe, but the policy looks unlikely to change in the US

Record highs on wheat prices have recently prompted European Commissioner for Agriculture and Rural Development, Mariann Fischer Boel, to propose an end to the ruling whereby farmers leave a proportion of their land fallow. About 56% of arable land in the EU is used for production of 'cereals'. The EU estimates that the policy change would free up four to seven million acres (1.6–2.9m hectares), which could theoretically produce as much as 17m metric tons of wheat. This would represent a meaningful 2.8% increase in world wheat production. The decision to farm ultimately rests with the farmer; however, both in the US and in the EU, thus it is difficult to predict whether they will plant or what crops they would choose to plant.

In the US, land is set aside under the Conservation Reserve Program (CRP). Theoretically, this land could be replanted and harvested, which would add 9% to total US arable and permanent cropland, but, by definition, it is environmentally sensitive (thus conflicting with other environmental concerns that drive the case for greater use of biofuels). In addition, farmers may agree to idle land that is not as economically viable as the rest of their land. We see three reasons why the US is unlikely to expedite the release of acreage: 1) it would substantially dampen the futures market for grains, and farmers like high prices; 2) it would cause a heavy backlash from environmental activists; and 3) the EU announcement takes some of the pressure off the US to do the same.

Figure 20: US Conservation Reserve Program acreage assumptions

Crop allocation, in millions of acres

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Corn	5.7	6.0	6.2	6.7	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8
Sorghum	1.0	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Barley	1.0	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Oats	0.5	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Wheat	8.8	8.4	8.7	9.3	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
Upland cotton	1.5	1.5	1.6	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Soybeans	5.3	5.5	5.7	6.1	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2
Subtotal	23.8	23.5	24.4	26.2	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5
Other	10.9	11.4	11.8	12.7	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8
Total	34.7	34.9	36.2	38.9	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3

Source: USDA

South American potential to expand arable acreage is very significant

(ii) South America appears to have the greatest potential to expand arable acreage. The Inter-American Development Bank recently issued a report discussing the arable outlook for various South American countries (see *A Blue print for Green Energy in the Americas*, April 2007). It points out that only 10% of available arable land in Paraguay and only 30% in Argentina and Colombia is cultivated. Maximising cultivation in these three countries alone would add 4.9% to the world's pool of arable land. In Brazil, the potential is even greater. Credit Suisse's Brazilian agricultural analyst, Luiz Octavio Campos, points out that there are 106m hectares of unallocated land potentially available for agricultural development in Brazil, which would add another 6.9% to global arable acreage. Thus, in total, global arable acreage could increase by 11.8% if land use were maximised in these four South American countries. In addition, there is scope to convert some of Brazil's 220m hectares of pasture to arable land and employ more intensive techniques in livestock farming.

Figure 21: **Use of land in Brazil (2006)**

	Hectares, m	% of total
Amazon rain forest	350	41%
Breeding pastures	220	26%
Protected areas	55	6%
Annual crops	47	6%
Permanent crops	15	2%
Cities, towns, lakes, roads & swamps	20	2%
Cultivated forests	5	1%
Subtotal	*707*	*83%*
Other uses	38	4%
Unexploited area still available for agriculture	106	12%
Total	851	100%

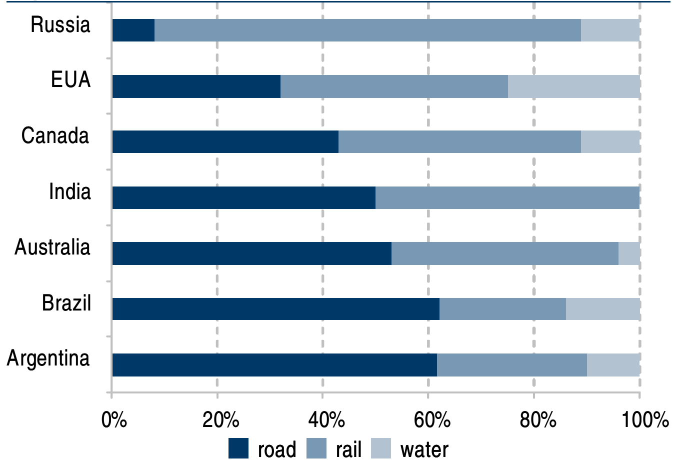
Source: Conab

The main cap on greater agri-exports from Brazil is the infrastructure

However, the major issue across South America is infrastructure. The main agricultural production areas of Brazil (in the mid-west) are situated, on average, 1,500km from the nearest of the country's three main ports. Argentina is somewhat better off: the distance to the main ports (Rosario and Buenos Aires) is c300km.

Brazilian and Argentinian investment in railways has fallen behind in a global context.

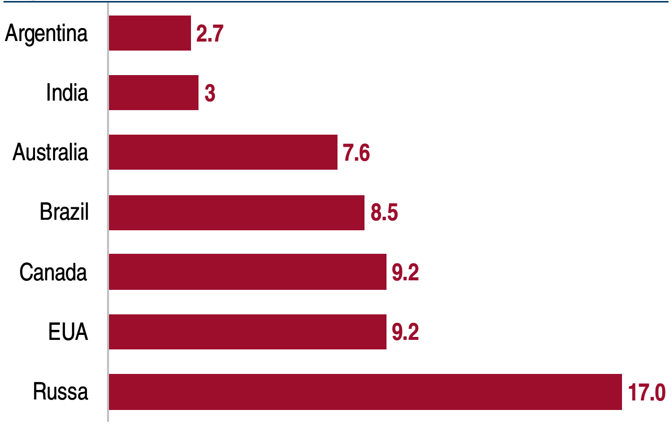
Figure 22: **Transport matrix (1)**



(1)excluding pipelines and air

Source: CIA World Factbook, 2006

Figure 23: **Territorial extension, land (km2, m)**



Source: CIA World Factbook, 2006

Paved highways are also relatively limited: 30% of Argentina's highways are paved, but in Brazil, it is less than 10%.

The transportation issue adds to the cost of production, particularly in Brazil. The USDA estimates that the cost of logistics alone when exporting soybeans from Brazil is, on average, 83% higher than in the US and 94% higher than in Argentina.

Steps are being taken to address the problem, however. In January 2007, the da Silva government in Brazil launched a forecast cR$58bn investment programme (to be delivered between 2007 and 2010) under the banner Programa de Aceleração do Crescimento, or PAC. The plan incorporates: (i) maintenance and construction of 45,300km of highways: (ii) 2,500km of railways; and (iii) modernisation of 12 ports.

In January 2007, Brazil's government launched a forecast cR$58bn expenditure programme to improve the transport infrastructure

Figure 24: **Brazil: Programme to accelerate growth investments in transport infrastructure (R$bn)**

Investment	
Highways	33.4
Railways	7.9
Ports	2.7
Airports	3.0
Maritime	11.3
TOTAL	**58.3**

Source: Ministério da Fazenda

Recently, the Brazilian government held an auction for seven lots of the Federal Highway Concession Program. More than 2600km of roads spanning the south and south-east of the country were offered to the bidder with the lowest tariffs. 30 companies participated in the auction in which the winners earned 25-year concessions. R$9bn are expected to be invested in asphalt duplication and restoration. Another R$10bn of spending is planned to equip the highways with ambulances, tow services, traffic inspection, mobile and fixed weighing stations and a telephone for each kilometre.

The USDA put the expected rate of land expansion towards crop and livestock production in Brazil at 4.5% (or about 1.8m hectares) per annum over the next 10 years. However, while this suggests significant growth in Brazil, it would represent only 0.1% growth pa in a global context, which is unlikely to be enough to meet the current rates of growth in global demand.

(iii) Indonesia also has great potential for expansion and has been aggressively expanding its oil palm cultivation in the past 10 years, at a CAGR of about 6–7%. Indonesia potentially still has half of its land available for planting, according to government statistics. This land has not been planted previously for three reasons: (a) lower and so less attractive palm-oil prices, (b) shortage of labour and good seedlings; and (c) the hang-over from the financial crisis of 1997/98 left many Indonesian corporates strapped for cash. Indonesia is aggressively going ahead with planting oil palms on this logged-over land now, but will likely face strong resistance from the NGOs if they encroach on virgin jungle. Nevertheless, using all the temporary fallow land (102m hectares) could add 6.6% to the pool of total global arable land. Obviously, this will take time to realise, but in conjunction with acreage expansion in South America should help ease supply bottlenecks.

Figure 25: **Land usage in Indonesia (2003)**

	mn ha
Total land area of Indonesia	192.3
As of year 2003	
Wet land	8.4
House compounds and surroundings	5.7
Dry land/Garden	11.0
Shifting cultivation	4.5
Meadows	2.4
Swamps	4.8
Dyke	0.5
Water pond	0.3
Wood land	10.4
Estates	18.3
Others	24.0
Temporary fallow land	102.0

Source: Indonesian Department of Agriculture

The other major region that could be a source of some acreage expansion (or at least much higher yields) is around the Black Sea. Commercial farming has not yet developed to a substantial degree in Russia, nor has a functioning agricultural credit market. Russia has been particularly slow to introduce legal protection of contracts and land reform. Over time, we think it would make sense for Russia to use its budget surplus from crude oil to accelerate investments in infrastructure, increase the productivity of its grain industry, and reduce its imports of protein.

Figure 26: **Top 10 global producers by major crop: 2006/07 production data**

Corn

Country	Production (MT)	%	Hectares	Yield
United States	267.6	38%	28.6	9.36
China	145.0	21%	27.0	5.37
Brazil	50.0	7%	13.7	3.64
EU-27	55.2	8%	8.7	6.38
Argentina	22.5	3%	2.8	8.04
Mexico	22.0	3%	7.4	2.97
India	15.0	2%	8.3	1.80
Canada	9.0	1%	1.1	8.47
South Africa	6.5	1%	2.8	2.32
Nigeria	7.8	1%	4.7	1.66
Other	101.4	14%	43.5	2.33
World	702.0	100%	148.5	4.73

Wheat

Country	Production (MT)	%	Hectares	Yield
EU-27	124.8	20%	24.5	5.10
China	104.0	17%	23.2	4.48
India	69.4	11%	26.4	2.63
United States	49.3	8%	18.9	2.60
Russia	44.9	7%	23.7	1.89
Australia	23.0	4%	11.2	2.05
Pakistan	21.7	4%	8.4	2.60
Canada	25.3	4%	9.7	2.61
Turkey	17.5	3%	8.6	2.03
Iran	14.8	2%	6.9	2.63
World	610.4	100%	212.6	2.79

Soybeans

Country	Production (MT)	%	Hectares	Yield
United States	86.8	39%	30.2	2.87
Brazil	59.0	27%	20.7	2.85
Argentina	47.2	21%	15.9	2.97
China	16.2	7%	9.3	1.74
India	7.7	3%	8.1	0.95
Paraguay	6.5	3%	2.4	2.69
Canada	3.5	2%	1.2	2.89
Bolivia	1.7	1%	0.9	1.94
EU-27	1.2	1%	0.5	2.50
Ukraine	0.9	0%	0.7	1.25
World	221.6	100%	93.9	2.51

Palm

Country	Production (MT)	%	Yield
Indonesia	4.5	43%	3.77
Malaysia	4.1	40%	4.31
Nigeria	0.7	6%	2.12
Thailand	0.2	2%	2.56
Colombia	0.2	2%	4.18
Papua N Guine	0.1	1%	4.00
Cote d'Ivoire	0.1	1%	
Cameroon	0.1	1%	
Ecuador	0.1	1%	
Congo	0.1	1%	
World	10.3	100%	3.71

Sunflowerseed

Country	Production (MT)	%	Hectares	Yield
Russia	6.8	22%	5.9	1.14
EU-27	6.5	22%	4.0	1.63
Ukraine	5.3	18%	3.9	1.36
Argentina	3.5	12%	2.4	1.46
China	1.9	6%	1.0	1.90
India	1.3	4%	2.1	0.60
United States	1.0	3%	0.7	1.36
Turkey	0.8	3%	0.5	1.46
Pakistan	0.5	2%	0.4	1.28
Serbia	0.4	1%	0.2	1.90
World	30.1	100%	23.9	1.26

Cocoa

Country	Production (MT)	%
Ivory Coast	1.3	37%
Ghana	0.7	21%
Indonesia	0.4	13%
Cameroon	0.2	5%
Nigeria	0.2	5%
Brazil	0.2	4%
Ecuador	0.1	3%
Dominican Rep	0.0	1%
Malaysia	0.0	1%
Other	0.3	10%
World	3.5	100%

Sugar

Country	Production (MT)	%
Brazil	26.9	19%
EU-27	21.4	15%
India	21.1	15%
China	9.4	7%
United States	6.7	5%
Mexico	5.6	4%
Australia	5.3	4%
Thailand	4.8	3%
Pakistan	2.6	2%
South Africa	2.6	2%
World	144.9	100%

Rapeseed

Country	Production (MT)	%	Hectares	Yield
EU-27	16.0	35%	5.4	2.98
China	12.7	27%	7.0	1.83
Canada	8.5	18%	5.0	1.71
India	5.8	13%	6.6	0.87
United States	0.6	1%	0.4	1.53
Ukraine	0.6	1%	0.4	1.54
Russia	0.5	1%	0.5	1.09
Australia	0.5	1%	0.7	0.71
Pakistan	0.3	1%	0.2	1.30
Bangladesh	0.3	1%	0.3	0.82
World	46.2	100%	26.8	1.73

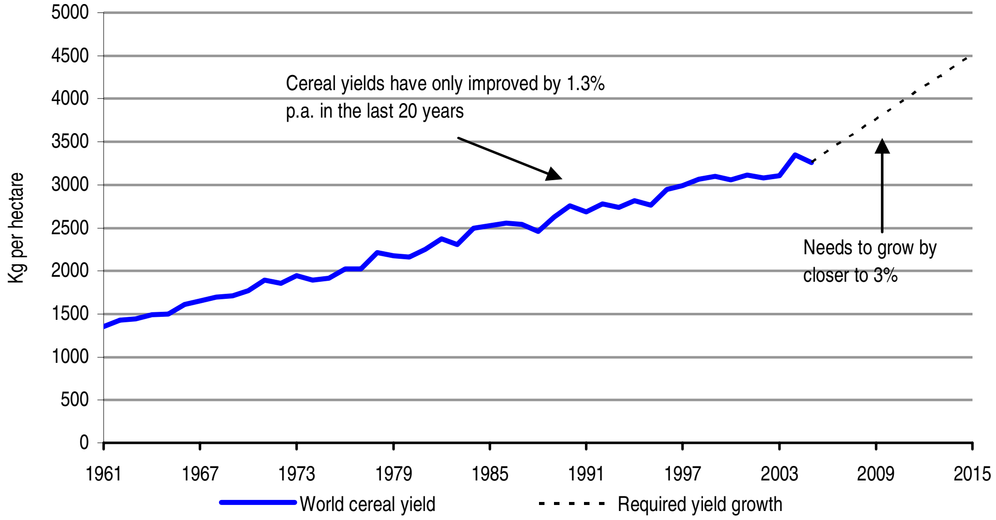
Source: USDA Foreign Agricultural Service's Production, Supply and Distribution Database

2: Productivity pressure

The onus on increasing output, therefore, falls on productivity. As a proxy for food productivity, we have considered the growth rate in cereal yields. Over the past 45 years, world cereal yields have grown by 2.0% per annum on average, but over the past 20 years, the rate of growth has slowed to just 1.3% per annum, which is some way short of the rate required to match demand growth.

Cereal yields have only improved by 1.3% per annum in the last 20 years. In order for supply growth to match demand, we estimate they would need to grow at closer to 3%

Figure 27: **Cereal yields in kilograms per hectare**

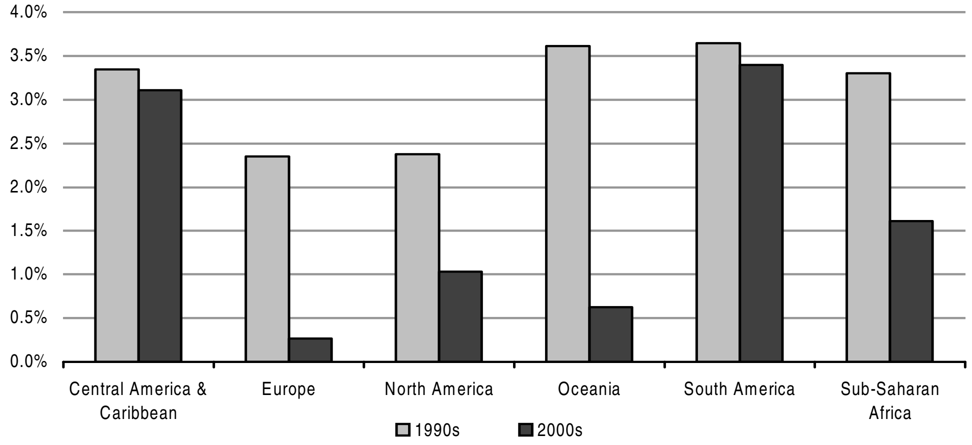


Source: FAO, Credit Suisse estimates

In fact, the evidence suggests that, rather than higher growth rates, the limits of agricultural intensification are already being reached. Growth in food production has slowed significantly in all the major regions apart from Central and South America. The average annual growth rate of food production in Europe, for instance, has fallen to 0.3% over the past five years compared with 1.9% in the period 1960–99, although this in part reflects the reverses of some of the CAP (Common Agricultural Policy) excesses.

Arguably, the limits of agricultural intensification are already being reached in some areas

Figure 28: **Annual average growth in food production**

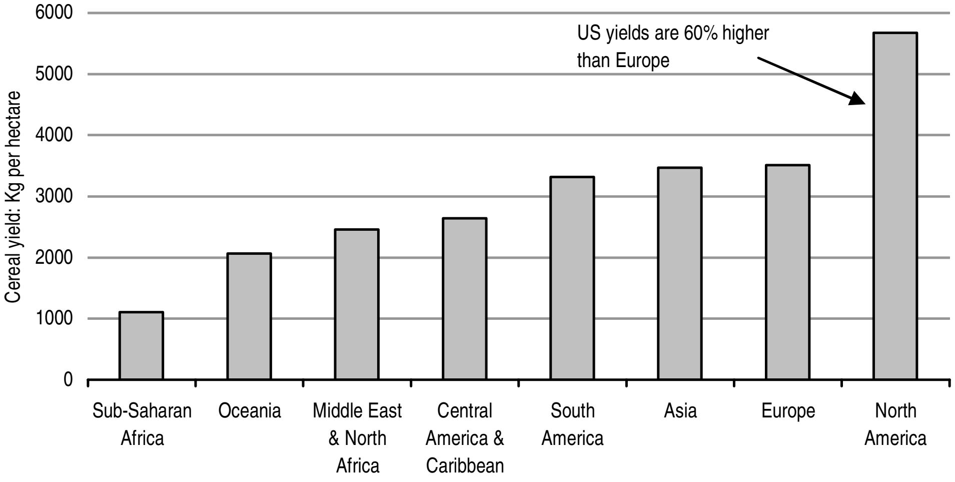


Source: FAO

Declining grain inventories are a sign that the world has had trouble keeping up with demand in recent years.

However, there is a wide variation in yields achieved around the world. At 5,675 kg per hectare, cereal yields in North America in 2005 were 60% higher than those of Europe and 174% higher than those of Oceania.

Figure 29: **Cereal yield by region: Kg per hectare, 2005**



Source: FAO

Much of this difference can be explained by regional geography and climate but it is also a function of variable factors (e.g. fertiliser use, seed type, irrigation, farm organisation). We consider the 'catch-up' potential in more detail in Part 3 of the Implications section of this report, entitled Raising agricultural output.

Supply summary

Our conclusions on supply are:

1. **Arable acreage** is likely to see small net growth in the global total as contractions in some markets (e.g. China) are offset by expansion in South America and Indonesia. The USDA put the expected rate of expanding area to crop and livestock production in Brazil at 4.5% (or about 1.8m hectares) per annum over the next 10 years. However, while this suggests significant growth in Brazil, this would represent only 0.1% growth in the global acreage per annum which is unlikely to be enough to meet the current rates of growth in global demand. Even if we assume, more optimistically, that half of the total potential in Indonesia and South America can be realised over the next 10 years, it still only equates to just less than 1% pa. Reducing the amount of land tied up in the US CRP and the European equivalent could also add to global arable acreage, but this is (a) far from certain and (b) again, quite small in a global context.
2. With limited growth in arable acreage, we think the onus is on **increasing agricultural productivity**. FAO data show that over the past 45 years, world cereal yields have grown by 2.0% per annum on average, but over the past 20 years, the rate of growth has slowed to just 1.3% per annum, which is some way short of the rate required to match demand growth (3.3% pa, we estimate).

In summary, we believe that supply is likely to continue to struggle to keep up with demand over the next few years, with clear implications for prices.

Implications

We consider three broad implications on the equity markets of the trends in agricultural supply and demand.

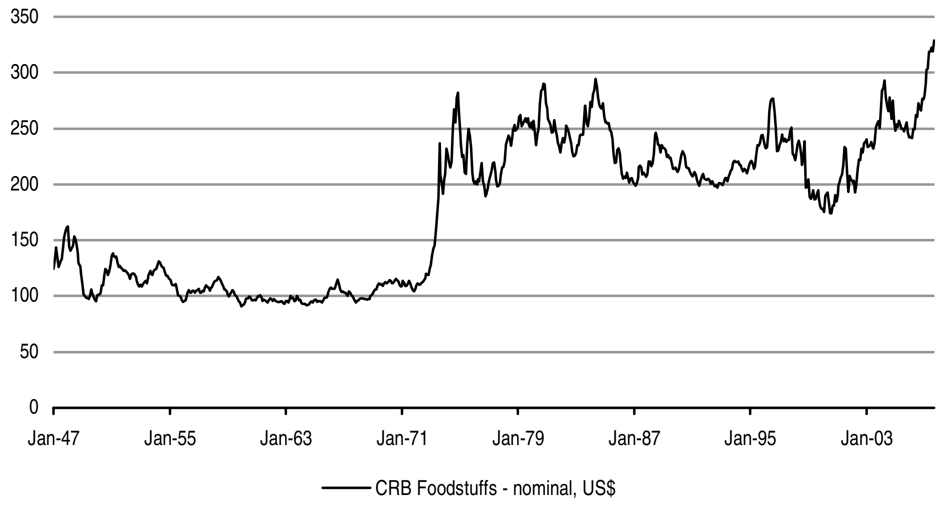
1. We consider the impact of higher agricultural prices on macro parameters such as CPI and trade accounts. Emerging markets are more exposed to food inflation but are generally in a better net trade position. We also look at the impact of higher agricultural prices on the food producers, food processors and food retailers. Value in the food chain shifts away from the consumer towards the raw material producers.
2. We look at the implications and trends in the global trade of agricultural products (we see the key potential beneficiaries as Argentina and Brazil).
3. We look at the potential for higher rates of agricultural productivity through greater use of irrigation, fertilisers, farm machinery and transgenic crops. Irrigation potential is considerable in certain areas, as is the greater use of GM crops. Fertilisers tend to be over-used and wasted in key production areas, which may limit relative earnings growth for the fertiliser producers.

(1) Higher food prices

The obvious conclusion is that food prices are likely to come under upwards pressure. Prices of key crops have been on an upward trend since late 2000 and, in nominal terms, have recently hit all-time highs.

Prices of key crops have been on an upward trend since late 2000 and, in nominal terms, have recently hit all-time highs

Figure 30: **CRB (Commodity Research Bureau) Foodstuffs: Spot prices, nominal US$ terms**

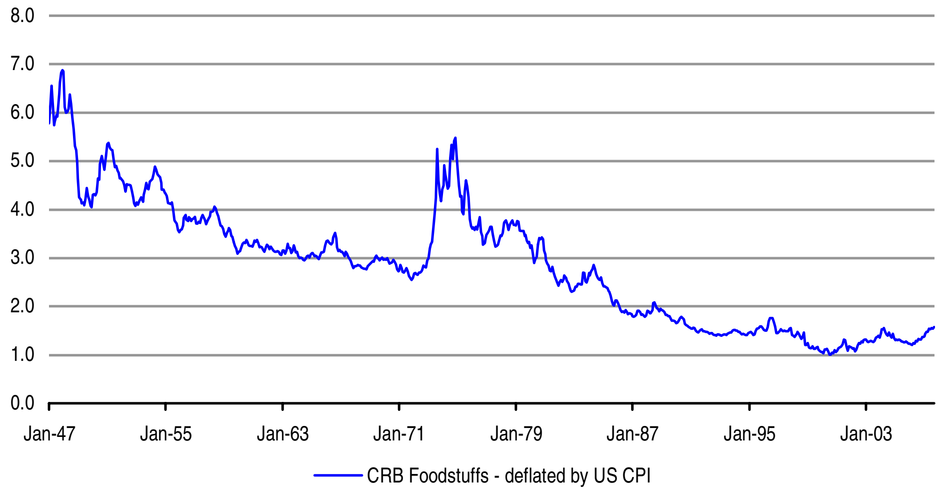


Foodstuffs include hogs, steers, lard, butter, soybean oil, cocoa, corn, Kansas City wheat, Minneapolis wheat, and sugar.
Source: CRB.

In real terms, however, prices remain depressed relative to their long-run history. Despite strong rises in the past two years, in real terms food prices are still 15% below their 30-year average and 70% below their 1973 peak.

Figure 31: **CRB Foodstuffs: Spot prices, real terms***

In real terms, food prices are still 15% below their 30-year average

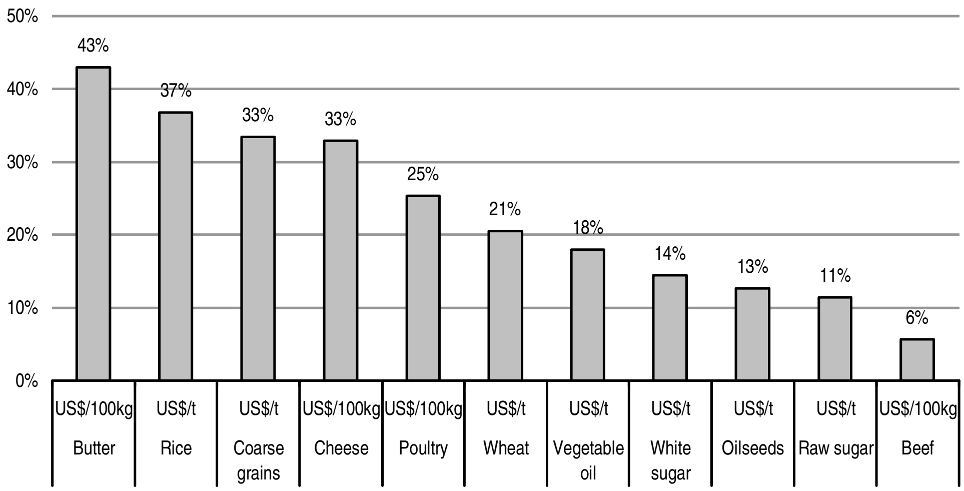


Foodstuffs include hogs, steers, lard, butter, soybean oil, cocoa, corn, Kansas City wheat, Minneapolis wheat, and sugar.
** deflated by US CPI*
Source: CRB.

High nominal prices in the past 18 months to some extent reflect weather-related shortfalls. Australia's wheat harvest this year is now forecast by the Australian Bureau of Agriculture and Resource Economics to be 12m tonnes, less than half the country's average of 25m tonnes a year on the back of continuing drought problems. These problems may prove to be transitory. However, the demand-side drivers are likely to persist, in our view.

The OECD-FAO joint report on the global agricultural outlook for 2007–16 (published in June 2007) forecasts moderate price rises from current levels but then some easing as the effects of recent drought-related shortfalls fall away. Nevertheless, it forecasts prices will remain well above the averages established in the past five years.

Figure 32: **OECD/FAO food price projections: 2016E compared to 2001–06 average price**



Source: OECD, FAO, Credit Suisse research

We suspect this forecast trajectory is probably too conservative. It seems unlikely to us that supply growth will, in aggregate, outstrip demand growth over the next three to five years, which implies mounting price pressures.

Ultimately, higher prices should elicit a sufficient response from the supply side (new technologies in biofuel production, more meaningful growth in arable acreage or changes in trade tariffs and quotas) or some alleviation of demand-side pressures (a new US administration could, further down the line, back-track on Bush's biofuel targets). Interestingly, according to Reuters reports (July 2007), China has slashed its biofuel production target (from five million tonnes by 2010 to two million tonnes) precisely because it appeared to be adding to food inflation. Malaysia has postponed its Biofuel Act Policy, which was to have stipulated a 5% biodiesel blend in 2008, as high vegetable oil prices have made biodiesel too expensive to subsidise. Russia has imposed retail price controls in order to head-off public discontent over rising food prices.

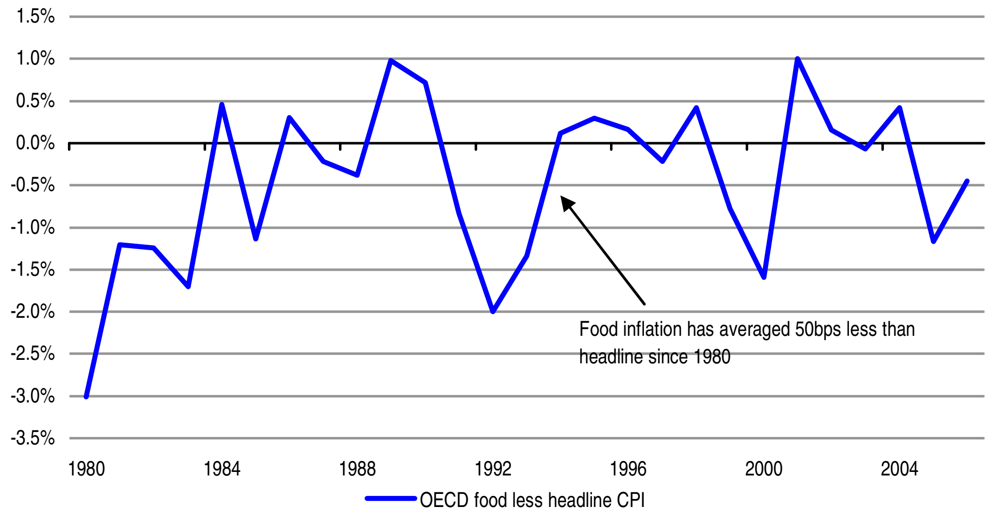
For the time being, we think any meaningful change in US or European biofuel targets is unlikely—we think it is too early politically and there would be insufficient economic impact on voters. In short, we expect prices to remain high (with risks to the upside) for the next couple of years.

Implications of higher food prices

(i) Macro implications: Impact on CPI and the terms of trade

Headline inflation indices have declined and remained low for much of the past 20 years, thanks in part to low food price inflation. Since 1980, food price growth has averaged 50 bps below the OECD CPI rate. In 2005, food CPI was lower than headline CPI in 27 out of 30 of the OECD markets. However, this positive contribution looks to be falling away. In the 12 months to the end of September 2007, food CPI is higher than headline CPI in 19 out of 30 OECD markets, including the US, the UK, Japan and the aggregate for the EU 15.

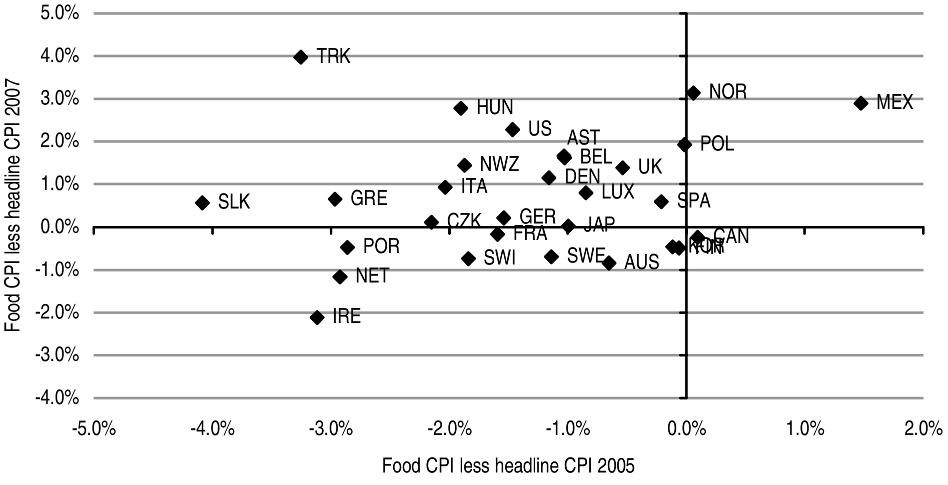
Figure 33: **Total OECD Food CPI less Headline CPI**



Source: OECD, Credit Suisse research

Since 1980, food price growth has averaged 50bps below the OECD CPI rate

Figure 34: **2005 and 2007 food relative to headline CPI**

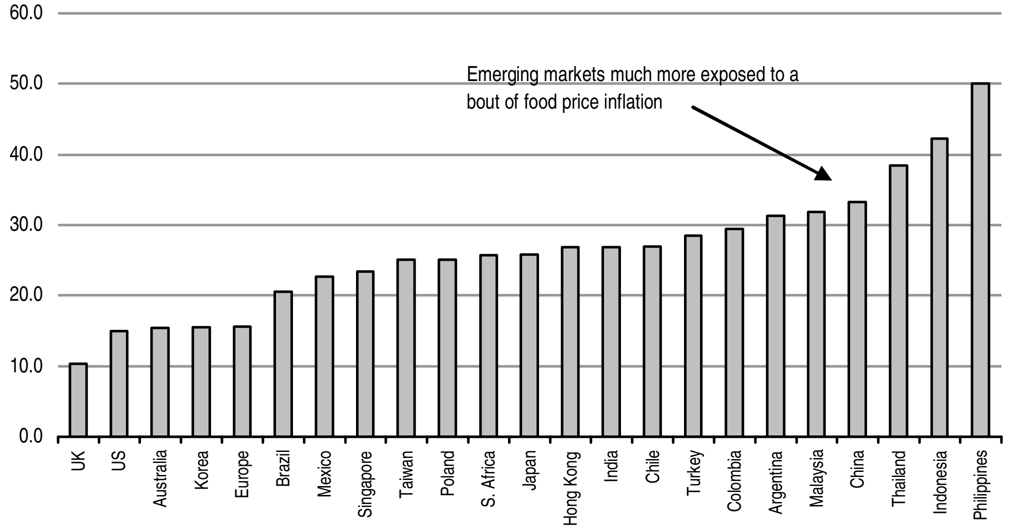


Source: OECD, Credit Suisse research

Higher food price increases are likely to be felt more keenly in those markets where food makes up a greater proportion of the inflation basket. Principally, this means the emerging markets are more exposed than the developed markets.

The emerging markets are more exposed than the developed markets to rising food prices

Figure 35: **Weight of food in the CPI basket**



Source: OECD, National Accounts, Credit Suisse research

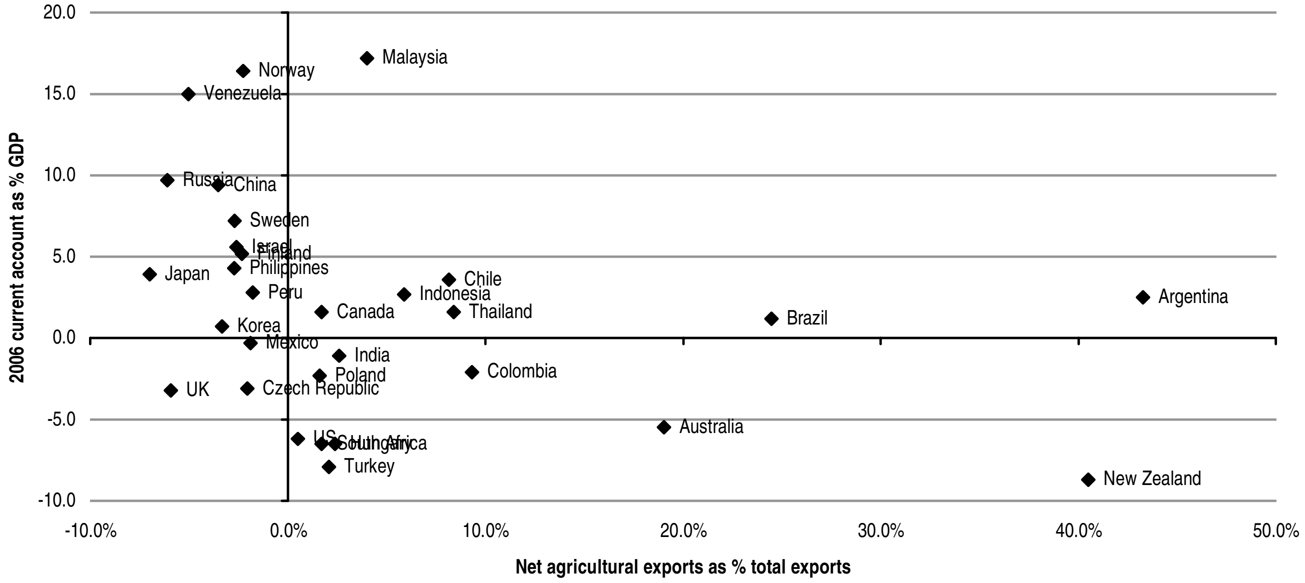
However, many of the emerging markets are also net agricultural exporters. As agricultural prices rise their terms of trade improve and, *ceteris paribus*, currencies could appreciate. Argentina, Brazil, Malaysia and Indonesia look particularly well positioned to benefit from this trend given that (a) in all instances they continue to run current account surpluses (on 2007 estimates of 1.2%, 0.8%, 15.3% and 1.8%, respectively; (b) each is likely to expand export volumes; and (c) net agricultural exports make up a significant proportion of overall exports (43%, 24%, 4% and 6%, respectively, in 2006).

However, many of the emerging markets are also net agricultural exporters

Potentially, this puts all four in a *relatively* strong position on the domestic demand front (since agriculture is also a reasonable proportion of GDP and the workforce should benefit from the more profitable environment) and given that a healthier trade position should reduce any domestic pressure on interest rates. Brazil is perhaps one of the strongest in

Brazil looks particularly well placed to benefit from higher agri-prices this respect: Credit Suisse forecasts 4.8% GDP in 2008 (following 4.7% in 2007E) and another 150 bps off the benchmark Selic rate to bring it down to 9.75% by end 2008E.

Figure 36: **Net agricultural exports as % of total exports vs current account as % GDP**



Source: FAO, IMF, Credit Suisse research

Australia and New Zealand are also in very strong trade positions. However, it is not all good news. One reason for at least short-term strength in agricultural prices is continued disappointing harvests from Australia due to poor weather conditions. Higher agricultural prices are positive but with limited volume growth, the Australian economy has struggled to capitalise on the situation.

The clear relative losers from the rise in agri prices are Japan, the UK, China and Korea. The major oil exporters, Russia and Venezuela, are also significant net agricultural importers.

(ii) Impact on the food chain

From a top-down perspective, the potential beneficiaries of these trends in food prices and demand are concentrated in agricultural production and potentially *across* the food chain in the emerging markets. In our view, the relative losers are those with less flexibility to pass on higher input costs and where volume growth is not likely to offset tighter margins (in other words, the processed end of the developed market food chain). Figure 37 organises some of the major listed food producers according to their contribution to the food chain.

Figure 37: **The food chain: listed stocks producing and processing food**

	Crop processors	Biofuel processors	Meat/dairy producers	Processed food producers
Developed markets	Archer-Daniels-Midland (US)	Petrotec (German biodiesel producer)	Smithfield Foods (US hog and beef processor)	Nestle (Switzerland)
	Corn Products International (US)	VeraSun Energy Corp (US ethanol producer)	Tyson Foods (US meat processor)	Unilever (Netherlands)
	Suedzucker AG (German sugar beet producer)	BioPetrol Industries (Swiss biodiesel producer)	Australian Agricultural Co (Aus cattle producer)	Kraft Foods (US)
		Biofuels Corp plc (UK biodiesel producer)	Meiji Dairies (Japan)	Danone (France)
		China Biodiesel Intl (China based, London listed)	Nippon Meat Packers (Japan)	Kellogg Company (US)
			Saputo Inc (dairy, Canada)	General Mills Inc (US)
			Dean Foods (dairy, US)	Campbell Soup Company (US)
			Maple Leaf Foods Inc (pork processor, Canada)	HJ Heinz Company (US)
			Campofrio Alimentacion S.A. (meat products, Spain)	ConAgra Foods Inc (US)
			Itoham Foods Inc. (meat products, Japan)	Sara Lee Corp (US)
				The Hershey Company (US)
				Cadbury (UK)
				Fuji Oil (chocolate inputs, Japan)
				Ajinomoto (Japan)
				QP Corporation (Japan)
				Associated British Foods (UK)
				Parmalat (Italy)
				Northern Foods (UK)
Emerging markets	Bunge (NY listed Brazilian oilseed producer)	São Martinho (sugar and ethanol producer, Brazil)	Rainbow chicken (poultry, S Africa)	Tigerbrands (S Africa)
	Tongaat Hullet (sugar, S Africa)	Cosan (sugar and ethanol producer, Brazil)	Astral Foods (poultry, S Africa)	Bimbo (Mexico, bakery)
	Illovo Sugar (sugar, S Africa)	China Agri-Industries Holdings (ethanol fuel producer)	Sadia (meat processing, Brazil)	Wimm-Bill-Dann (Russia)
	Sime Darby (palm oil, Malaysia)	Brasil Ecodiesel (largest biodiesel producer in Brazil)	Perdigao (meat processing, Brazil)	Tingyi (beverages and noodles, HK-listed)
	KL Kepong (palm oil, Malaysia)		China Yurun Food Group (meat processor, HK listed)	CJ Corp (food processor, Korea)
	Wilmar (palm oil, Indonesia)		China Mengniu Dairy (HK listed)	Nestle India (food processor)
	IOI Corp (palm oil, Malaysia)		People's Food holdings (meat processor, Singapore listed)	IndoFood Sukses Makmur (Indonesia)
	Golden Hope (palm oil, Malaysia)		Charoen Pokphand Foods PCL (meat and fish, Thailand)	Gruma (corn and wheat products, Mexico)
	SLC Agricola (Brazil)		Maeil Dairy Industry (Korea)	Nong Shim (Korea)
	BrasilAgro (Brazil)			Britannia Industries Ltd. (India)
	Cresud (crops and livestock, Argentina)			AVI (S Africa
	Astra Agro Lestari (Indonesia, palm oil)			Universal Robina (Philippines)
	Chaoda Modern Agriculture (China crops, HK listed)			Molinos Rio de la Plata S.A. (flour, Argentina)
	China Green (Holdings) Ltd. (China crops, HK listed)			Samyang Corp (Korea)
	Xiwang Sugar (China corn processor, HK listed)			
	Global bio-chem (China corn processor, HK listed)			
	Bajaj Hindustan Ltd. (sugar, India)			

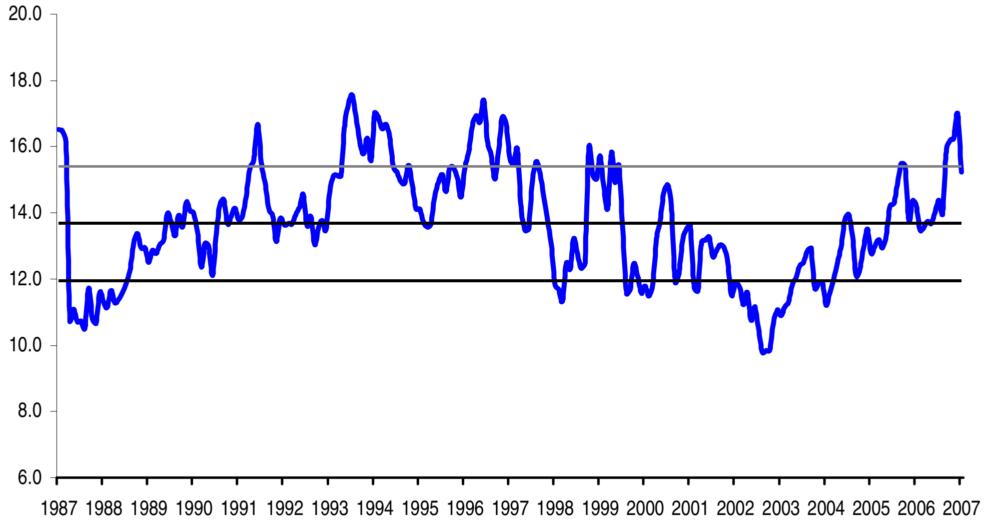
Source: Credit Suisse research

(a) The crop processors

In the face of rising agricultural prices, performance has been particularly strong. Over the last year, the Dow Jones global farm and fishing index is up 56% (versus MSCI World index up 22%). Valuations versus its historical absolute performance look relatively stretched.

Against their own history, the valuations of the crop producers look relatively stretched

Figure 38: Global crop producers: Aggregate 12-month forward PE

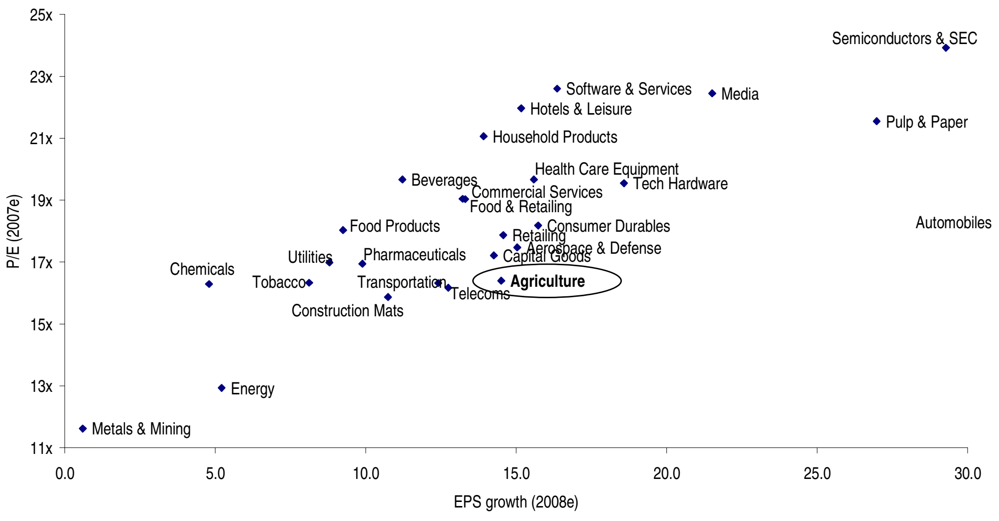


Source: IBES, Credit Suisse research

However, valuations still appear attractive relative to other sectors.

However, compared to other sectors, crop producers still appear to offer value

Figure 39: Global sector valuations: Trailing P/E versus 12-month forward growth



Source: I/B/E/S, Credit Suisse estimates and research

Of the major listed crop producers around the world, the bulk of them are rated Outperform by our analysts, as we illustrate in Figure 40.

Figure 40: **Listed crop processors (priced 30/10/07)**

		Main output	Mkt Cap (US$bn)	Rating	2008E P/E	2008E P/sales
Archer-Daniels-Midland	US	Corn and oilseeds	22,605	Underperform	12.0	0.5
Corn Products Intl	US	Corn	3,100	NR	16.9	1.1
Suedzucker AG	Germany	Sugar	4,176	NR	23.1	0.5
Bunge	NY listed, Brazilian prodn	Oilseed	12,933	Outperform	21.7	0.3
Tongaat Hullet*	South Africa	Sugar	1,498	Neutral	17.6	1.6
Illovo Sugar*	South Africa	Sugar	1,233	Outperform	12.8	1.4
Sime Darby	Malaysia	Palm oil	8,416	Outperform	22.0	1.3
Golden Hope	Malaysia	Palm oil	4,090	Outperform	18.3	2.5
KL Kepong	Malaysia	Palm oil	4,545	Outperform	19.9	3.1
IOI Corp	Malaysia	Palm oil	11,787	Outperform	24.8	4.0
SLC Agricola	Brazil	Cotton, Soy and corn	856	Outperform	20.2	6.8
BrasilAgro	Brazil	Agricultural property	405	Outperform	NA	NA
Cresud	Argentina	Crops and beef	710	NR	17.6	14.9
Astra Agro Lestari	Indonesia	Palm oil	2,613	Outperform	18.0	5.2
Indofood Agri	Indonesia, Singapore listed	Palm oil	1,375	Outperform	21.5	0.1
London Sumatra	Indonesia	Palm oil	767	Outperform	14.0	3.3
Wilmar	Indonesia, Singapore listed	Palm oil	18,942	Neutral	25.6	2.2
Chaoda Modern Agriculture	HK listed, China based	Crops and livestock	2,174	Neutral	6.1	4.0
China Green Ltd	HK listed, China based	Crops and livestock	693	NR	11.9	7.2
Xiwang Sugar	HK listed, China based	Corn	438	Neutral	8.7	1.3
Global Bio-Chem	HK listed, China based	Corn	945	Neutral	8.4	1.3
China Agri	China	Diversified grains and crops	2,348	NR	16.3	1.1
Bajaj Hindustan Ltd	India	Sugar	550	NR	14.2	1.6

**Denotes a Credit Suisse Standard Securities covered company, a joint venture involving Credit Suisse.*
Source: IBES consensus estimates for Not Rated stocks, Credit Suisse estimates. CSSS estimates

We highlight:

Bunge: Bunge is the world's leading oilseed processor with an attractive global asset footprint in North America, Eastern and Western Europe, China and India. As the leading soy processor and fertiliser producer in Brazil, we think Bunge is well-positioned to capitalise on agricultural expansion in the region. Bunge is also the leading exporter of soybeans to China. It has a vertically integrated business model in Brazil and has operated there for over 100 years, giving it a competitive advantage when buying assets or procuring commodities from farmers. Bunge's normalised profits in 2006 were 40% from agribusiness (including crop financing, crop origination, processing and transporting grain), 40% from Brazilian fertilizer, and 20% from food products. Sales growth has averaged 6% over the past three years and average earnings growth 9% per annum. Credit Suisse's Consumer Staples analyst, Robert Moskow, forecasts above-trend EPS growth over the next two years due to the likelihood of soy acreage expansion in the region beyond the 5–7% annual trend and above-trend fertiliser sales to farm customers. Bunge has also started to acquire sugar processing assets in the region, which have potential synergies with its dry bulk asset platform and fertiliser business.

SLC Agricola: SLC Agrícola is one of Brazil's largest cotton, soybean and corn producers. It has approximately 135,000 hectares of owned land and production of 354,000 metric tons in the 2005/06 harvest. We forecast earnings growth of 46% per year for the 2007–10 period. We expect growth to be driven by: (i) scope to increase the second harvest; (ii) plans to lease and use areas close to current farms to take full advantage of economies of scale; and (iii) acquisition of new farms (the recent IPO raised nearly R$308m in acquisition capital). SLC is currently trading on 20.2x 2008E earnings.

BrasilAgro: BrasilAgro is a start-up company, founded in 2005. The company's stated strategy is to: (i) identify, acquire and lease rural properties that present attractive prospects for agricultural production; and (ii) add market value, producing a diversified range of agricultural products through the use of high technologies. The company launched an IPO in May 2006 to fund its business plan and raised R$550m net of proceeds from the market and its founding shareholders, which include TARPON Investimentos, Elie Horn (CEO of Cyrela) and Cresud. Since its IPO, BrasilAgro has already committed R$210m to investments in properties (38% of net IPO proceeds). In our view, BrasilAgro is one way that equity investors can participate in the significant potential for land price appreciation in Brazil. As Credit Suisse analyst, Luiz Campos, points out, productive land in Brazil trades at a multiple much lower than that in the US and Argentina. Rising agricultural prices, greater global trade and investment in Brazil's infrastructure should see this gap close over the medium term.

While sugar is the most efficient feedstock in ethanol production, palm oil is currently by far the most efficient method of producing biodiesel.

Sugar is the most efficient feedstock in ethanol production; palm oil is currently by far the most efficient method of producing biodiesel

Average oil yields from palm are 3.7 T/ha/year (IOI Corp has oil yields of over 6 T/ha/year) while other oilseed crops such as soybean, rapeseed and sunflower only yield 0.4 T, 0.6 T and 0.5 T/ha/year, respectively. Due to palm oil's high yields, only 9.2m hectares of agricultural land (0.6% of the global total) are devoted to produce 32% of current global fats and vegetable oils output. A similar output from soybeans would require 92.5m ha.

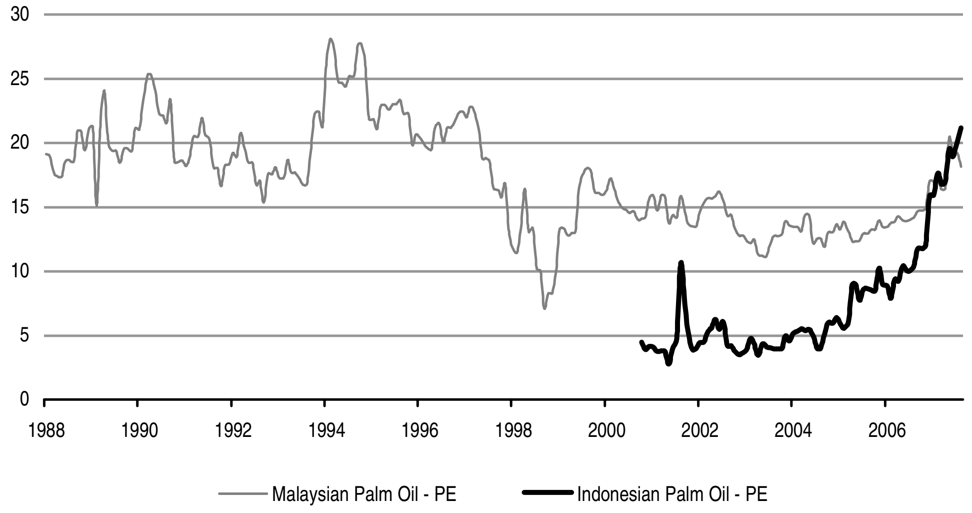
Indonesia will likely be the largest producer of palm oil in 2007, overtaking Malaysia for the first time

Indonesia will be the largest producer of palm oil in 2007, overtaking Malaysia for the first time. Credit Suisse expects Indonesia's palm oil production to reach 17.2m tonnes in 2007 versus Malaysia's 15.7m tonnes. Nevertheless, Malaysia will still be the biggest exporter of palm oil in the world, exporting 90% of its production. Oil palm acreage in Indonesia has seen a CAGR of 11% over the past four years versus Malaysia at only 3%, as Indonesia has more land and cheap labour.

There are several proxies to the Indonesian palm oil sector, but Credit Suisse has Outperform ratings on **Indofood Agri, Astra Agro Lestari** and **London Sumatra**. Astra Agro's principal activities are the operation of oil palm (just over 240,000 hectares), rubber (3,000 hectares) and cocoa plantations. The company's revenues and earnings, together with other Indonesian palm oil companies, have recently been tweaked down by us marginally due to government regulatory changes, but we still anticipate 85% EPS growth for this year and 21% for next, which would be more than enough growth to justify an 18x 2008E PER. The one caveat on Indonesian palm oil is regarding rising concerns from various European lobby groups (e.g., Friends of the Earth) which claim that Indonesian farmers are illegally destroying frontier forest in order to plant palm crops or are using unsustainable farming methods. These allegations have been strongly denied by Indonesian operators (such as Wilmar) but may give rise to some sort of labelling system in the EU.

We see several ways to play the Malaysian palm oil sector, including **Sime Darby, KL Kepong** and **IOI Corp**. All these companies derive more than 60% of their profits from upstream palm oil activities and are, therefore, very leveraged to rising palm oil prices. The proposed merger of **Sime Darby** with **Golden Hope** and **Kumpulan Guthrie** (scheduled for November 2007) is set to create a new entity by the name of Synergy Drive. Post-merger, Synergy Drive should be the world's largest listed oil palm company by crude palm-oil (CPO) production (it is likely to account for about 6% of global CPO output) as well as Malaysia's largest property developer by landbank. Synergy Drive expects to derive cost and revenue synergies resulting in EBIT improvement of RM500mn p.a. beginning 1 July 2009. Credit Suisse's analyst Tingmin Tan points out that this appears a little conservative, but even if that is the case, there is plenty of upside potential in both Sime Darby and Golden Hope to reach the fair value implied by these gains.

Figure 41: **Indonesian vs Malaysian palm oil stocks: 12-month forward P/E multiples**



Source: I/B/E/S, Credit Suisse research

Indonesian palm-oil stocks have enjoyed a significant re-rating over the last three years. They now trade on similar multiples to their Malaysian counterparts

In our view, an indirect way to play the same theme is via the credit institutions that extend financing to the agri-producers. **Banco do Brasil** has more than a 60% share in agricultural lending, which accounts for some 34% of its total loan portfolio. There are several government programmes that offer subsidised rural loans and develop Brazilian agriculture, and Banco do Brasil is the main agent for their implementation. Agricultural lending at the bank grew by 26% in the 12 months to end of Q1 2007. Higher agricultural prices underpin future loan growth in this area, in our view, as well as lowering provisioning requirements through the boost to credit quality. In addition to lending to the rural sector, the bank also participates in government programmes to support minimum prices, being a market maker for commodities at times of pricing crises and financing the storage costs for strategically important export crops such as rice, beans, corn, soy, cotton and wheat. **Banrisul** is another way to play the theme, we think. Although rural financing operations are only responsible for around 9% (2Q07) of the bank's total credit portfolio, its operations are concentrated in the State of Rio Grande do Sul, where agriculture is particularly important. The knock-on effect of a strong agri-performance is likely to be felt throughout Banrisul's loan portfolio. We consider Banrisul as a very attractive stock for investors seeking growth stories at low multiples with exposure to the Brazilian agribusiness segment.

An indirect way to play the agricultural theme is via the Brazilian banks. Banco do Brasil looks set to benefit from greater agricultural lending, lower provisioning and lower interest rates

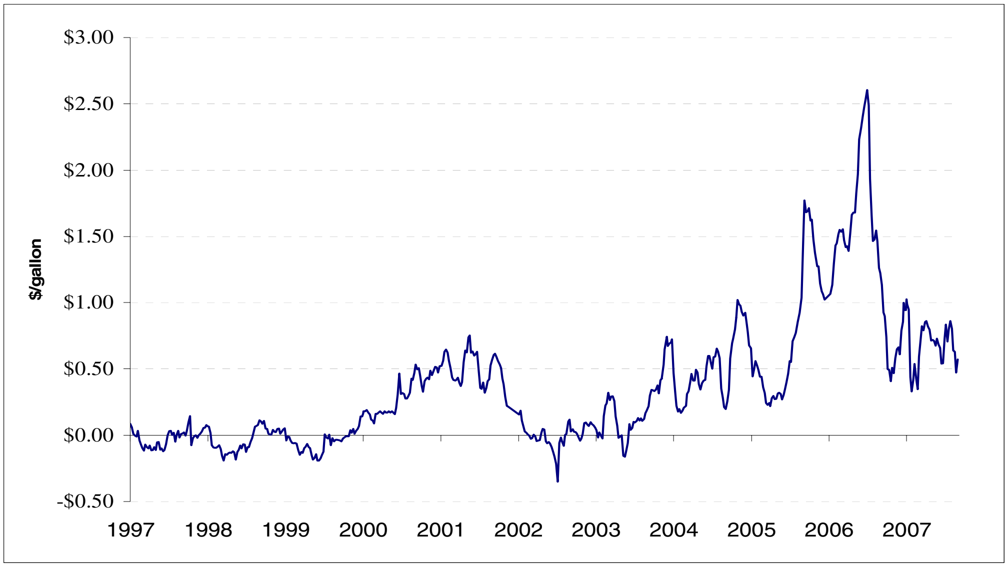
Agricultural lending has also been relatively strong over the past three years in India (roughly 30% CAGR). This partly reflects a government drive to increase lending to the agri sector (agri lending is part of the directed lending requirement for Indian banks) as well as growth in the broader rural economy. Credit Suisse's Indian banks analyst, Aditya Singhania, points out that **Punjab National Bank** offers reasonable exposure to growth in agricultural lending (c20% of the loan portfolio). However, Credit Suisse's Outperform rating on the stock has more to do with PNB's strong deposit franchise and relatively attractive valuations, than with trends in agricultural lending.

(b) Biofuel processors

Biofuel processors initially benefited from the rise in crude oil prices as ethanol and biodiesel prices rose in tandem. As we illustrate in Figure 42, this led to a substantial rise in ethanol margins over H2 2005 and H1 2006. However, from late 2006 higher crop prices took their toll and ethanol margins reverted to close to US$0.5/gallon. Integrated biofuel producers (**Cosan, São Martinho**) have fared better than their process-oriented competitors (**Petrotec** (Not Rated), **VeraSun**) but generally returns and earnings surprises have been negative. Is the bad news all in the price? Our base case of further rises in crop prices suggests not. There are three potential positives that could catalyse a turn-around: (1) Changes in government subsidies could help underpin earnings. However, we think there is scope for earnings to disappoint for a while before respective governments extend any further support. (2) Capacity shutdowns: this is starting to happen and while it does signal a difficult earnings environment for the industry it should ease the outlook for the lower-cost producers. (3) Ethanol prices (relative to gasoline) should improve as ethanol distribution channels are more comprehensively established and ethanol demand picks up.

Figure 42: **Long-term ethanol margins**

US$ per gallon



Source: World Fuels, Credit Suisse research

Biofuel processors initially benefited from the rise in crude oil prices as ethanol and biodiesel prices rose in tandem

However, from late 2006, higher crop prices took their toll and ethanol margins reverted to close to US$0.5/gallon

(c) Meat/dairy producers

There is a notable split in the performance of the emerging and developed market livestock providers. The emerging market stocks have generally enjoyed strong performance underpinned by high rates of domestic demand and rising volumes that have more than offset higher input costs. Developed market producers have faced margin pressures as volume growth has been insufficient to offset higher feed costs. In Figure 43 we present a selection of listed developed and emerging market stocks in the meat and dairy business. Typically, earnings growth has been stronger for the emerging market stocks (**Rainbow Chicken** and **Astral Foods** in South Africa, for instance, both returning earnings growth in excess of 100% over the past two years). One caveat is the impact of disease: avian flu severely depressed the earnings of **Sadia** and **Perdigao** in Q2 2006 despite an otherwise strong demand backdrop.

US-listed **Smithfield Foods**, meanwhile, has seen sales growth of 6% over the past two years but falling margins on rising input costs. The net result has been a 37% decline in earnings.

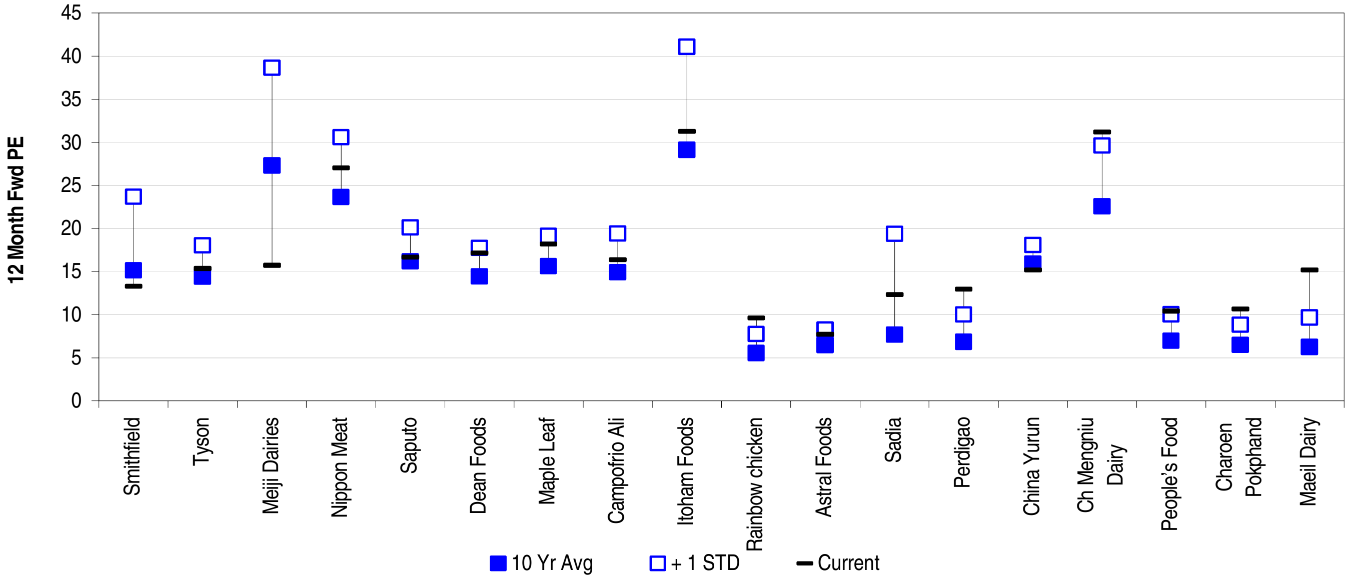
Figure 43: **Meat and dairy producers (30/10/07)**

Stock	Listing	Main product	Mkt Cap (US$m)	Rating	Historic 2 yr EPS gr	2008E P/E	2008E P/sales
Smithfield Foods	US	Hog and beef processor	3877	Neutral	-37.2%	11.2	0.3
Tyson Foods	US	Meat processor	5837	Neutral	NM	12.5	0.3
Australian Agricultural Co	AUS	Cattle producer	547	NR	24.2%	34.3	3.3
Meiji Dairies	JAP	Dairy products	1790	Neutral	30.6%	14.1	0.3
Nippon Meat Packers	JAP	Meat processor	2528	NR	-3.8%	19.9	0.3
Saputo Inc	CAN	Dairy products	4986	NR	3.2%	17.0	1.3
Dean Foods	US	Dairy products	3603	Neutral	25.4%	16.5	0.3
Maple Leaf Foods Inc	CAN	Meat processor	1983	NR	-96.1%	15.8	0.3
Campofrio Alimentacion	SPA	Meat processor	1099	NR	14.9%	13.9	0.8
Itoham Foods Inc	JAP	Meat processor	887	NR	-87.6%	25.8	0.2
Rainbow chicken	SAF	Poultry	682	NR	100.1%	9.3	1.0
Astral Foods	SAF	Poultry	817	NR	103.8%	8.3	0.8
Sadia	BRA	Meat processor	4359	Neutral	-25.0%	17.4	0.9
Perdigao	BRA	Meat processor	4305	Restricted	-83.1%	NA	NA
China Yurun Food Group	CHI	Hog processor	2042	Underperform	141.7%	21.5	2.7
China Mengniu Dairy Co. Ltd	HKG	Dairy products	6503	Outperform	130.4%	35.2	2.6
People's Food Holdings	SGP	Meat processor	997	Underperform	11.5%	9.8	0.9
Charoen Pokphand Foods PCL	THA	Meat and fish processor	1179	Underperform	43.5%	10.7	0.3
Maeil Dairy Industry	KOR	Dairy products	569	NR	NA	10.1	0.5

Source: I/B/E/S consensus estimates for Not Rated stocks, Credit Suisse estimates

However, valuations for the bulk of the emerging market stocks are now looking somewhat full, in our view (particularly for the Chinese corporates) and growth rates look unlikely to accelerate further from here. This leaves us relatively lukewarm on the sector.

Figure 44: **Meat processors: Current vs 10-year average 12-month forward consensus P/E multiples**



Source: I/B/E/S, Credit Suisse research

(d) Animal genetics

The other clear trend in the traded meat and dairy markets is the growth in animal genetics. In order to enhance livestock performance (in terms of, for example, feed conversion rates, yearly egg production, milk yields and growth rates) efforts have been concentrated on a few breeds of cattle, pigs and chicken. The results have been very positive.

Feed conversion rates have improved substantially

In the 1960s, 1 tonne of feed could be converted into 85kg of pork, now a tonne of feed yields 170kg of pork. Similarly, in the 1960s, 1 tonne of feed could be converted into 330kg of chicken, now it is 590kg. However, the trade-off has been a significant concentration in genetics which critics claim implies a significant loss of agricultural bio-diversity. For instance, the Dutch company Hendrix (unlisted) provides the genetics for the layer hens of 80% of the world's commercially produced brown eggs. 68% of globally traded white eggs are produced by layer hens originating from a German company, PHW (unlisted).

But pressure to increase yields has led to chronic gene concentration

According to the World Congress on Genetics Applied to Livestock Production (WCGALP), two-thirds of milk is produced by high-output breeds globally. Dairy cattle breeding focuses on a few, distinct objectives: milk amount and fat content, weight gain and feed efficiency. Breeding to enhance these traits has led to genetic narrowing to the extent that, despite the fact there are more than 3.7m milk-producing Holstein cows in the US, the effective breeding herd size of Holsteins in the US for 2004 was only 60 animals. The effective population sizes of Jerseys and Brown Swiss in the US are only 31 and 32 animals, respectively, on the WCGALP's 2004 estimates.

The FAO points out that relatively little has been done to develop breeds in the Southern hemisphere. Despite the risk of gene concentration, the pressure to produce higher and more efficient yields looks set to extend the trend in concentrated breeding to these markets as well.

There are four listed entries into this sector:

a) **Tyson's** breeding programme is operated through its subsidiary, Cobb-Vantress. It is the US market leader in poultry and beef production (with a 26% market share in each) and holds the number two position in pork production (with an 18% market share). As an integrated company, the breeding programme is mainly aimed at enhancing in-house yields rather than selling the technology to a third party.

b) **Genus plc** is a UK-listed stock that provides genetic solutions in cattle, pigs and shrimps. Genus operates in 30 countries on five continents and is now the world's leading bovine genetics company, the world's leading supplier of breeding stock to pig producers (35–40% market share in the Americas) and a leading supplier of breeding stock to shrimp producers with operations in Thailand, Mexico and Brazil.

c) The Dutch company **Nutreco** is Europe's largest feed producer and holds a significant position in turkey breeding (second-largest in the world behind PHW), broilers (fourth-largest in the world) and pigs (world's second largest pig breeder).

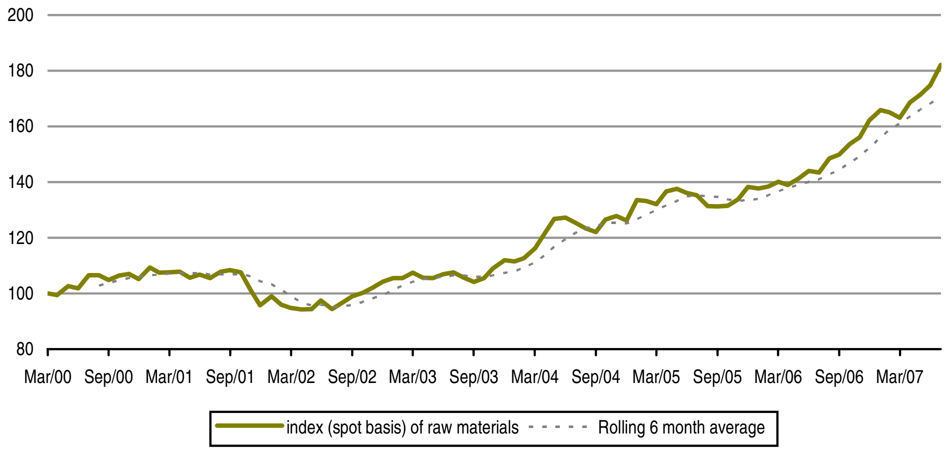
d) **Monsanto** has significantly extended its reach in pig genetics in recent years (its share of the US pig genetics market currently is c10%) with an agreement in 2004 with the genetic research company MetaMorphix, which in turn has near to exclusive access to the pig genome. Monsanto has filed a series of applications to patent the pig that suggests it plans fairly aggressive growth in this sector. It is also marketing a cattle semen sorting technology that can increase the proportion of calves of desired gender from 50% to 85%.

(e) Processed food producers

Grain forms the primary raw material in the food industry: 60% of the cost of producing meat is feed, 75% of the cost of flour is wheat. In conjunction with a sharp increase in packaging costs, Credit Suisse's food team estimates there has been a 30%+ increase in aggregate raw material costs for the food processing industry over the past four years. Agricultural prices alone (on a spot basis) have nearly doubled.

We estimate there has been a 30%+ increase in aggregate raw material costs for the food processing industry over the past four years

Figure 45: Index of global agricultural input costs for food manufacturers

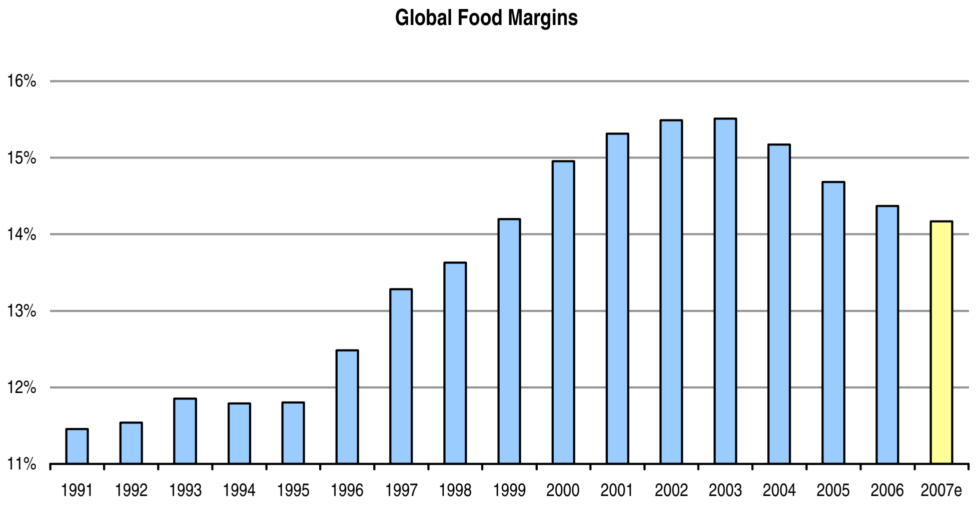


Source: Datastream, Credit Suisse research

The corollary of this is a decline in global food processing margins. The unprecedented rise in input costs has simply been particularly difficult—although pricing has been more evident, hedging has defrayed some costs, reformulations/mix has been a driver, industry margins have still declined by around 150 bps in four years.

The corollary of this is a decline in global food processing margins

Figure 46: Global food margins



Source: Company data, Credit Suisse estimates

Few companies have managed to buck the trend: declining margins have been a feature of most of the food companies under Credit Suisse coverage. However, there are degrees of change, depending on the ability of a food company to recover input cost pressures through pricing.

We believe there are two key variables to consider here:

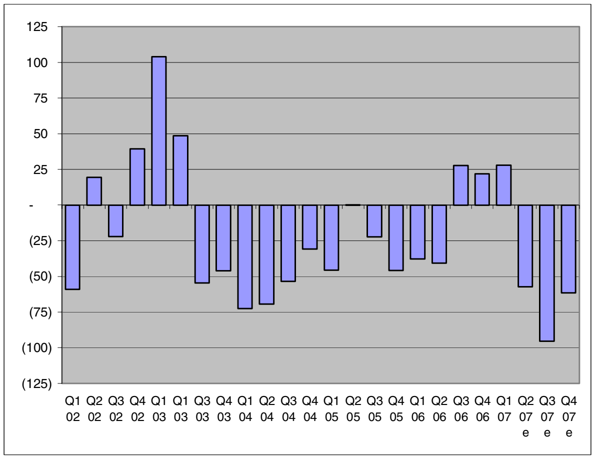
- Strength of brand. The stronger the brand, the better the pricing.
- Nature of market: the rule appears to be that the more commoditised the market, the tougher it is to get sufficient pricing.

The relative winners in this environment look set to be the big branded companies with greater margin cushion. **Nestle** (Outperform) falls into this category, in our opinion. Confectionery companies such as **Cadbury** (Underperform) and **Hershey** (Neutral) could also potentially weather the storm reasonably well but margins at both have disappointed as managements have had trouble passing on the full impact of commodity costs such as dairy and cocoa. **Unilever** also has considerable brand power in its defence but valuations and some questions over the strategic turnaround at the company leave us with another Underperform rating.

Northern Foods (Underperform) and **Associated British Foods** (Neutral) both suffer from a lack of relative brand power which suggests to us fairly muted margin performance over the next few years.

In the US, price increases have similarly lagged the impact of rising input costs. Companies that have managed to keep margins flat or even expand slightly have done so through internal cost reduction and efficiency efforts. As we show in Figure 47, we expect US packaged foods profit margins to decline this year on average despite some acceleration in pricing.

Figure 47: **Quarterly EBIT profit margin growth (in bps) vs prior year**



Source: Company data, Credit Suisse estimates. Includes Kraft, Kellogg, Hershey, ConAgra, Campbell Soup, General Mills, Heinz, McCormick, Wrigley

Figure 48: **Annual net price realisation (% growth) vs prior year**

	2002	2003	2004	2005	2006	2007E
K	1.0	1.0	1.5	1.5	2.0	2.5
KFT	(0.2)	1.6	0.9	1.4	0.7	2.0
HNZ	3.3	1.2	(0.2)	(0.1)	0.8	2.1
GIS		0.7	1.0	1.3	1.5	1.8
CPB		1.4	1.2	1.3	2.7	2.0
HSY	-	1.0	1.7	2.2	0.5	2.2
DLM	0.2	0.2	1.3	3.2	2.9	2.5
Average	0.8	1.0	1.0	1.5	1.6	2.2

Source: Company data, Credit Suisse estimates

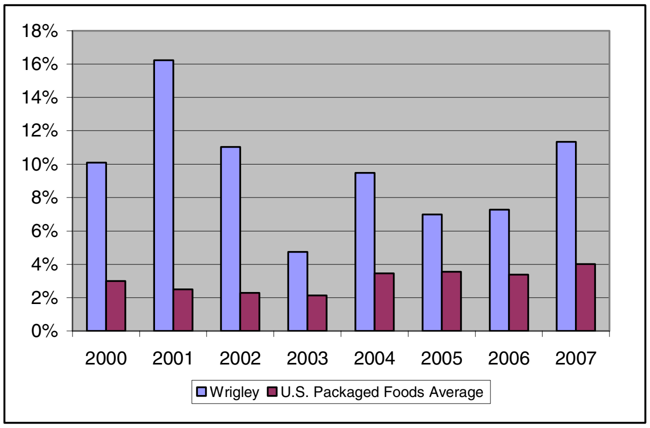
The bull case for packaged foods companies is that commodity costs will eventually level off or decline and price increases will stick, resulting in an easier environment for margin expansion. Our view is that the competitive environment is too intense in packaged foods not to share the benefit of lower costs. In general, it is quite easy to manufacture packaged foods products, so there is a lot of excess capacity on the market. There are hundreds of private label food producers with excess capacity that could be willing to operate below the cost of capital to compete for business. As a result, we believe that branded food companies will be forced to discount their prices once commodity costs start to lighten, rather than drop it to the bottom line.

Over the long term, we believe that packaged foods companies with strong influence over their turnover (sales) and strong brands can manage through the challenging environment. Resonant product innovation, shifting the mix of products toward value-added offerings and systematically improving the efficiency of operations should help insulate earnings. We believe that the following companies have competitive advantages and enough exposure to attractive categories and markets to withstand the challenges on the cost side.

Wrigley. The chewing gum category is attractive, in our view, because it is a duopoly with limited exposure to commodity food inputs and private label. Wrigley is the global leader with commanding market share in the US, the UK, Germany, Spain, China, Taiwan, Russia and Eastern Europe. With about 30% of its business in developing markets, and plenty of room for increased market penetration, Wrigley has the strongest sustainable growth rate of the US packaged food companies we cover.

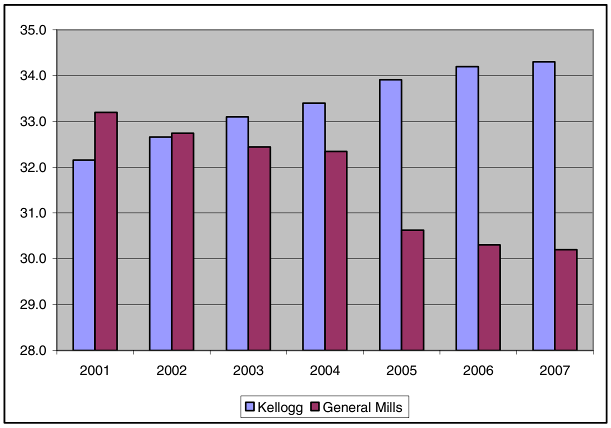
Kellogg. Kellogg has increased its market share in the US cereal category by 200 bps over the past six years by out-innovating the competition and reinvesting cost savings into consumer marketing support. About 50% of the company's sales are from breakfast cereal, and this category is increasingly appreciated by consumers as a healthier option for adults and children alike.

Figure 49: **Wrigley sales growth trends (excluding currency, acquisitions)**



Source: Company data, Credit Suisse estimates for 2007

Figure 50: **Kellogg and General Mills: US market share trends**

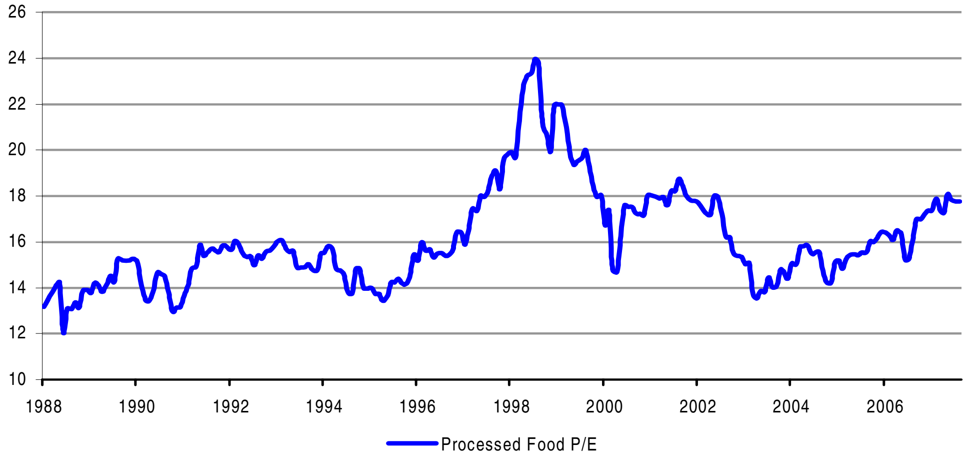


Source: AC Nielsen, FDM ex Wal-Mart, Credit Suisse estimates for 2007

In Japan, after years of consumer price deflation that forced cost cutting in order to maintain margins, the packaged and processed food companies are now facing a margin squeeze from rising input costs. Credit Suisse's Japanese consumer staples analyst, Yukiko Oshima, is similarly advocating a strategy of brand power and market leadership as the relative safe-haven in this scenario (see the *Japanese Food Sector Review*, published on 21 August 2007).

One of the few stocks we rate as Outperform in the sector is **Ajinomoto**. There are five reasons: (1) The company has relatively strong price power for MSG and seasonings supported by high market shares as well as by growing demand for these products across Asia as diets have adjusted. (2) Its feed-use amino acid business (one of the main profit generators for Ajinomoto) is likely to keep growing. We expect the supply/demand balance for feed-use amino acid to continue to tighten on the back of growing global demand for meat a well as the exit of one of the global producers from the market. (3) Health drives are promoting greater demand for amino acids. Ajinomoto is one of only a few companies in the world that can manufacture all 20 essential amino acids. (4) Over time, Ajinomoto could possibly develop a new method to make MSG using biomass and hence cutting input costs. (5) Our target price of ¥1600 is based on this fiscal year's EV/EBITDA multiple of 10, which is in line with the company's historical average and global peers.

Figure 51: **The global processed food sector: 12-month forward P/E**



Source: IBES, Credit Suisse research

Against their own history (and compared to other sectors), the processed food stocks do not look particularly attractive

(f) Food retailers

Credit Suisse's European food retail team points out that moderate food inflation (1–2%) can be a modest positive for food retailers, as companies can generally increase prices and maybe even protect some margin by:

- pressurising their suppliers, implying that food manufacturers will bear the extra costs;
- generating cost savings 1) helped by a better inventory management, 2) by improving staff productivity and/or 3) improving product mix.

However, high levels of inflation are probably negative. Rapid cost increases typically weigh on retailers' margins. It has been a challenge, for instance, for retailers to pass on rapid price increases in meat and dairy given consumer sensitivity to these products.

In addition, we note that raw material inflation proves to be an even tougher issue in countries or markets which are experiencing overall deflation. France is maybe the best example as a change in regulations in January 2006 allowed retailers to cut the price on national brands thereby triggering a price war. This partly explains our prevailing Underperform rating on **Casino Guichard.**

Retailers with a high exposure to independent labels (rather than big brands) face somewhat tougher problems as smaller independents typically have little or no room to absorb raw material price inflation. We can assume that inflation of private labels will increase faster than branded products. For instance, **Aldi** (not listed) in Germany has already increased the price of its dairy products as a result of milk price increases.

Typically, the food retail sector has proved relatively defensive during market volatility and slowing rates of global economic growth. However, we rate the sector as market weight as, despite defensive qualities, the difficult pricing environment looks set to weigh on margins from H2 2007.

Similar to European food retailers, Credit Suisse's US food retail team views food inflation of 1–2% as a modest positive for supermarkets but again, higher levels of inflation are generally seen as negative. Rapid cost increases have penalised the earnings of **Safeway, Kroger** and **Supervalu**, as quickly passing through to consumers pronounced inflation in dairy and meat has been a challenge. The companies believe they will ultimately be able to pass along these cost increases, but we think the best case scenario is maintaining gross profit dollars (which is neutral, not positive to earnings).

Structural changes have also had an impact on the industry over the past decade as consumer shopping patterns have moved away from the one-stop shopping of a traditional supermarket. Historically, this meant that supermarkets possessed a significant amount of pricing power. However, with the proliferation of non-traditional formats in the food retail landscape (super-centres, wholesale clubs, dollar stores, and Tesco's imminent launch in the US), that pricing power has rapidly eroded as supermarkets have been forced to lower prices in an attempt to maintain traffic. This secular change will likely play a more important role as food inflation increases and non-traditional chains react with a more competitive response.

Investors should also keep in mind that while food inflation is an important topic, shelf-pricing is not entirely dependent upon commodity pricing. On average, only about 20% of the value of an individual food item purchased at the supermarket is directly due to commodity pricing (also known as farm value). The vast majority of expenses continue to be related to 'marketing' expenses, specifically labour, packaging, and transportation. According to the USDA, labour continues to account for the biggest piece of 'marketing'-related expense and accounts for about 38% of the total marketing bill. So while commodity cost increases can have an impact on what the consumer ultimately spends, it is critical to understand that the vast majority of the cost input comes from other areas.

Most US food retailers remain confident that food inflation will eventually be passed on to the consumer, although we argue that today's historically high levels could prove difficult. Supermarkets are among the most defensive companies in retail, despite these longer-term secular issues. We note that the supermarket stocks have outperformed the market during each of the past three recessions. However, with food inflation weighing on margins we continue to rate the sector in the US as market weight.

In Japan, food retail margins have historically revolved around volume (lowering volumes without changing prices), but we have begun to see real price increases for some processed food products. We expect higher prices from suppliers/makers to come through over the course of Q4 2007 and we believe these are likely to be passed on to the consumer.

We believe price increases are likely to find traction, because: 1) major retailers have already raised prices for some products (from QP and Ajinomoto, for example); 2) the competition from drug stores appears to be winding down; and 3) prices for apparel, eating out, and other consumer areas have already begun to reflect inflationary trends.

Our preferred pick in the sector in Japan is **Aeon** due to its wide range of businesses and group synergy, higher growth in overseas businesses, stronger procurement power and relatively attractive valuation.

(2) Trade patterns

Despite acceleration in global agricultural trade in recent years, most countries maintain subsidies as a means of protecting their domestic farmers from crop price volatility and global competition. This is the constant sticking point of World Trade Organisation negotiations. The most recent Doha round stalled because the G-20 bloc (low income countries including Brazil, India and China) insist that the EU and the US are not providing a level playing field. A successful outcome to these talks would be a potential positive to agricultural processors in developing countries that are exporting food stuffs to developed markets. However, the politics of the situation are very complicated and heated, and we think they will continue to curtail the rate of growth in agricultural trade.

Nevertheless, the economics of comparative advantage have prevailed to some extent and despite the political interference, external trade in agricultural products has increased substantially over the past 20 years (from US$123bn in 1985 to US$393bn in 2004). This equates to an annual compound growth rate (in value terms) of 6.3%. However, agricultural trade has not increased as fast as all merchandise trade, resulting in a declining share to 6.4% (from 11.5% in 1985) of global exports. The International Grains Council (IGC) reports growth in export grain volumes of 2.2% per annum on average.

External trade in agricultural products has increased substantially over the past 20 years (from US$123bn in 1985 to US$393bn in 2004)

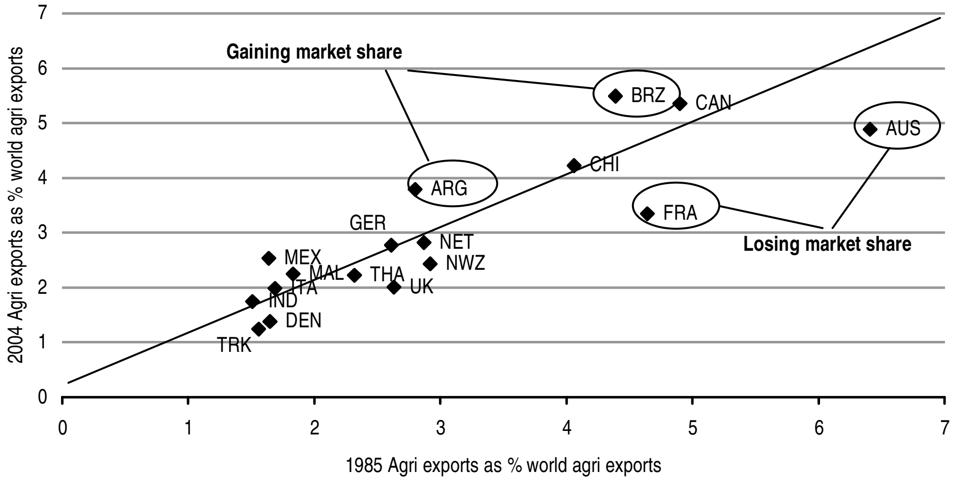
The trade data show that a few countries continue to dominate world trade in agriculture (the top 20 countries account for 75% of world agricultural trade on average between 2000 and 2004). Within the grain trade, the US, Argentina, Australia and Canada dominate, with over 50% of all exports. The US still has the lion's share of grain exports (31% of the seaborne trade total).

South America is gaining export market share at the expense of the US, France and Australia

South America, however, is gaining export market share at the expense of the US, France and Australia.

Brazil and Argentina offer considerable comparative advantage in agricultural production. Both have large areas of flat land with regular rainfall, relatively long growing seasons, and soil that can retain fertiliser. Despite all the transport and logistical problems, their share of total agricultural exports has increased—from 4.4% and 2.8% in 1985 for Brazil and Argentina, respectively to 5.5% and 3.8%, respectively, in 2004.

Figure 52: **1985 versus 2004 share of agricultural trade by country***



** US and EU15 total not shown as their share total export share (although declining) is off the scale*
Source: OECD, FAO, Credit Suisse research

The US's share of agricultural trade dropped from 22.8% of the world total in 1985 to 18.7% in 2004. France and Australia have also seen significant declines in their relative exports. Given drought problems in recent years and relative distance from end markets, this is possibly no surprise in Australia's case.

How to play this theme in the equity markets? The likely beneficiaries are transportation companies specialising in food and agricultural transportation and shipping.

ALL (America Latina Logistica) in Brazil should be a direct beneficiary of the government drive to improve Brazilian infrastructure and greater agricultural export volumes

In Brazil, railway upgrades and expansion should see much greater agricultural volumes on the tracks. The obvious beneficiary, in our view is **ALL (America Latina Logistica).** ALL is Latin America's largest independent logistics company, with concessions on railway lines in Argentina and Brazil (South, Midwest and Southeast regions). ALL offers rail transportation, domestic and international intermodal door-to-door transportation, dedicated fleet services and warehousing. It operates 1,000 locomotives, 29,700 rail cars, 1,200 highway vehicles, distribution centres and warehousing installations. ALL's rail network serves an area that accounts for approximately 75% of Mercosur's GDP. It serves seven of the most active ports in Brazil and Argentina through which approximately 78% of all South America's grain exports are shipped annually. Agricultural commodities correspond to around 70% of ALL's railway volumes. In addition, ALL strongly benefits from fertiliser imports. Fertiliser is a 'return cargo' as it flows from ports to the farms. It adds extra revenues over almost the same cost base, hence improving profitability. Volumes have grown by 37% over the past two years (CAGR) and we expect 10–12%

growth per year over the next few years. ALL is currently trading on 35x Credit Suisse 2008E earnings and a FCF yield of 1.7%, slightly better than the global average for port operators at 36x 2008E earnings and negative FCF.

Petrobras is one of the few companies that is looking to boost the transport of ethanol. In March, Petrobras ethanol manager (Oliva Filho) announced company plans to start construction of a US$750m ethanol pipeline in H2 07. The pipeline would take about two years to complete and have the capacity to transport eight billion litres of ethanol from the production area in Goias state, to the Paulinia refinery, in Sao Paulo, and, from there, to the port of Sao Sebastiao. In addition, Petrobras has announced plans to add to its tanker fleet with specialist ethanol tankers. Given the contamination risk ethanol cannot be transported in an oil/petroleum product based tanker. Petrobras says it plans to treat its new tankers to resist the corrosive effect of biofuels. It expects costs of cUS$130mn per vessel, which will be built in Brazil at the Sermetal shipyard in Rio. The first of these is not scheduled for completion until 2011.

Historically, the chemical trade has been very regionally oriented—intra Asia, Mediterranean, Northern Europe and the Caribbean. However, should ethanol trade become global, some of the public chemical tanker companies that could benefit are the Oslo listed shipping companies of **Eitzen, Odfjell** and **Stolt-Nielsen**.

Eitzen points out that nearly all 121 of its ships are capable of shipping ethanol (with a few exceptions where the coating is insufficient). Since 1 January 2007, the IMO (International Maritime Organisation) has specified that palm oil has to be transported in double-hulled ships. In response, Eitzen is phasing out its single-hulled ships and replacing them with the required Type II vessels. The company expects growth of between 5% and 10% in ethanol and palm oil transportation over the medium term. Within that, the strongest growth rates (8–10%) are likely to stem from Brazil, according to the company.

(3) Raising agricultural output

There are four main avenues for increasing agricultural yields.

(a) Irrigation

Efficient irrigation can improve crop yields by 10–30%. According to the FAO database, just 5.6% of the world's agricultural land is irrigated compared to 3.1% in the early 1960s, although much of this irrigation is still deemed to be highly inefficient (with less than half of the water on average actually reaching the crop).

There are two issues here: (i) to increase the total area under irrigation, and (ii) to improve the efficiency of existing irrigation.

On the first point, the FAO estimates that the bulk of the unrealised irrigation potential lies in the developing markets. Within that, it argues that the greater part of unrealised potential lies in sub-Saharan Africa and Latin America.

Figure 53: Irrigated area and irrigation potential

	Irrigated Area (Mha)	Potential irrigated area (Mha)	Irrigated area as % potential
Sub-Saharan Africa	5.3	38.1	14
Latin America	19.7	73.0	27
Near/East and North Africa	26.6	44.3	60
India	50.1	104.4	48
South Asia	73.4	89.5	82
China	53.8	67.3	80
East Asia	18.7	46.8	40
World	271.7	554.4	49

Source: UN FAO

The FAO estimates that the bulk of the unrealised irrigation potential lies in the developing markets

Maximising the irrigation potential in developing markets implies doubling the current irrigated area.

Secondly, on irrigation efficiency, the ICID (International Commission on Irrigation and Drainage) advocates sprinkler (such as centre pivot) and drip irrigation as the most efficient prevailing techniques in irrigation.

Centre pivot irrigation is a form of sprinkler irrigation consisting of several segments of pipe joined together and supported by trusses, mounted on wheeled towers with sprinklers positioned along its length. The system moves in a circular pattern and is fed with water from the pivot point at the centre of the arc. Most centre pivot systems now have drops hanging from a u-shaped pipe called a gooseneck attached at the top of the pipe with sprinkler heads that are positioned a few feet (at most) above the crop, thus limiting evaporative losses. Drops can also be used with drag hoses or bubblers that deposit the water directly on the ground between crops. The crops are planted in a circle to conform to the centre pivot. These systems are common in parts of the US and South Africa where terrain is flat and for cereal crops where replanting and ploughing takes place at least annually.

Drip irrigation applies water slowly to the roots of plants by depositing it either on the soil surface or directly to the roots through a network of valves, pipes, tubing and emitters. Drip irrigation may also use devices called micro-spray heads, which spray water in a small area, instead of dripping emitters. These are generally used on tree and vine crops with wider roots. Subsurface drip irrigation, or SDI, uses permanently or temporarily buried dripper-line or drip tape located at or below the plant roots. Drip irrigation typically induces higher crop yields and lower water requirements (depending on the crop and the location). For example, in Himachal Pradesh in India, drip irrigation of apple trees has been found to increase fruit yields by 10–45% and water saving by 25%.

The use of irrigation varies widely between countries. According to the International Commission on Irrigation and Drainage (ICID) India and China have significant potential to increase the efficiency of their irrigation.

Figure 54: **Sprinkler and drip irrigation in selected countries (2000)**

Country	Sprinkler irrigation (million ha)	Drip irrigation (million ha)	Total area irrigated by modern methods (million ha)	As percentage of total irrigated area
China	1.20	0.27	1.47	2.8
France	1.40	0.05	1.45	90
Germany	0.53	0.002	0.532	100
Israel	0.07	0.16	0.23	100
India	0.66	0.26	0.92	1.6
Italy	0.35	0.08	0.43	16
Jordan	0.005	0.038	0.043	62
South Africa	0.26	0.22	0.48	37
USA	3.38	1.05	4.43	21

Source: ICID (International Commission on Irrigation and Drainage)

Irrigation appears to be high priority in China and India

In China, at present, sprinkling and drip irrigation makes up just less than 3% of the total irrigated acreage. The total area of arable land is 130m hectares and 45% is irrigated (by one form or another). According to the Minister of Water Resources, Wang Shucheng, China plans to increase its water-saving irrigation areas by 10m hectares and build more than 17m irrigation works in the rural areas of the north-western, south-western and northern parts of the country by 2010.

In India, a task force was set up in 2003 to investigate the benefits of greater and more efficient irrigation methods. The committee recommended increasing the area under irrigation by 3m hectares over the Tenth Plan period (2004–05 to 2006–07) and a further 14m (8.2% of total arable land in India) over the Eleventh Plan (2007–08 to 2011–12). This would entail a total investment of INR615bn (US$137bn) from fiscal year 2004–05 through to 2011–12 (equivalent to 300 times the industry's current annual sales). Implementation of the recommendations is already underway in states like Andhra Pradesh, Maharashtra and Gujarat.

Hong Kong-listed Xinjiang Tianye Water Saving Systems and Jain Irrigation in India offer exposure

Hong Kong-listed **Xinjiang Tianye Water Saving Systems** provides water irrigation systems and has 70% market share in Xinjiang (a western province in China). Relatively high installation costs have been hindering the growth for Xinjiang Tianye Water's products outside Xinjiang, but government-funded irrigation projects are underpinning growth. Net profit at Xinjiang Tianye Water Saving grew 9% in 2006 and 12% y/y in Q1 2007. **Eurodrip Irrigation Systems** in Greece, **Jain Irrigation** in India and **Plastro Irrigation** in Israel are the other major listed irrigation providers. **Lindsay Corp** in the US manufactures centre pivot and lateral move and hose reel irrigation equipment. Through its subsidiaries, Lindsay operates in the US, Europe, South America and southern Africa.

Figure 55: **Irrigation providers**

Stock	Main listing	Ticker	Mkt Cap 30/10/07 (US$m)	2008E P/E	2008E P/sales
Jain Irrigation	India	JAIR.BO	858	21.6	2.7
Xinjiang Tianye Water Saving Systems	Hong Kong	8280.HK	59	12.8	2.5
Eurodrip Irrigation Systems	Greece	EDPr.AT	70	18.0	0.9
Lindsay Corp	US	LNN.N	558	29.5	1.7
Plastro Irrigation	Israel	PLSTR.TA	588	NA	NA

Source: I/B/E/S consensus estimates

(b) Fertilisers

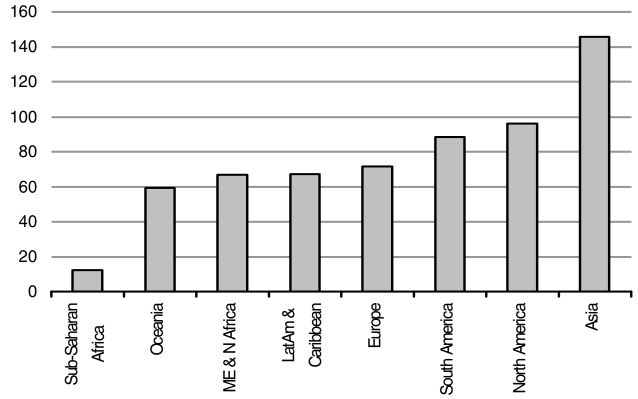
Global fertiliser demand has revived in the last 12 months on the back of rising agri-prices and better farm profits. In recent corporate results, Bunge's fertiliser division has surprised on the upside, Potash Corporation reported record Q2 results (EBIT up 117% y/y) and K+S results were also strong (Q2 EBIT up 30% y/y).

Fertiliser demand should be fairly robust from here, but growth rates look likely to differ substantially between regions

Aggregate global demand should remain fairly robust from here, but growth rates look likely to differ substantially between regions. There are considerable differences in fertiliser application rates and practices that suggest that fertiliser use is haphazard, at best, in some parts of the world. The FAO suggests that fertiliser tends to be substantially under-used in Africa and parts of the Caribbean and Central America but over-used pretty much everywhere else (particularly in Asia).

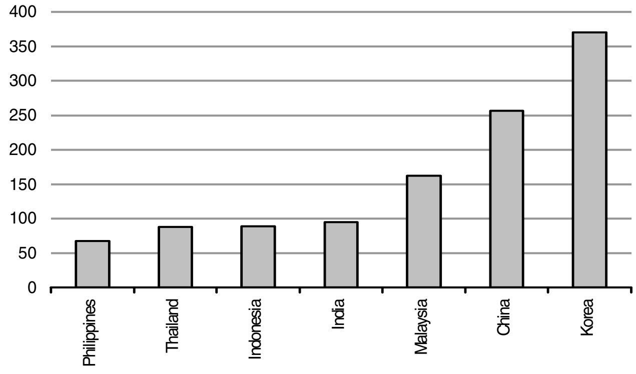
There is significant growth potential for fertilisers in Africa (where only 13% of the global average is used). On the other hand, Asia uses more fertiliser per hectare (courtesy of China and Korea) than any other region. Asian fertiliser use (in kilograms per hectare) is 1.5 times higher than it is in the US.

Figure 56: **Regional fertiliser use: Kg per hectare (2005)**



Source: FAO

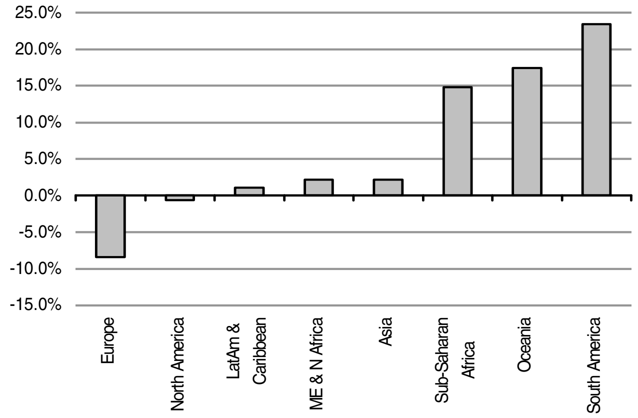
Figure 57: **Asian fertiliser use: Kg per hectare (2005)**



Source: FAO

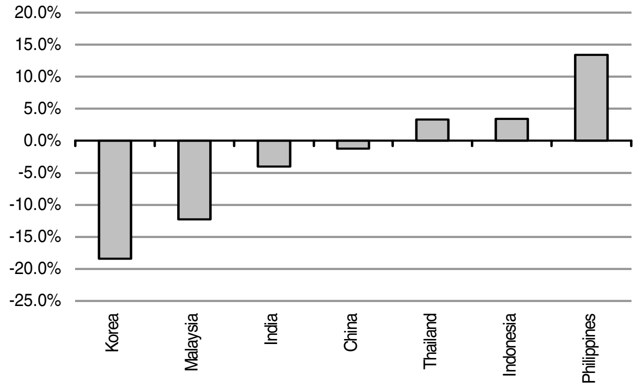
Growth in fertiliser consumption between 2000 and 2005 was strongest in South America, Oceania and Sub-Saharan Africa. Fertiliser use in Europe, North America and China over that period declined.

Figure 58: **Growth in regional fertiliser use: % change 2000–05 (in Kg per hectare)**



Source: FAO

Figure 59: **Growth in Asian fertiliser use: % change 2000–05 (in Kg per hectare)**



Source: FAO

These trends are interesting in that they match the results of FAO studies on "growth-limiting factors" in agriculture. While fertiliser use is a limiting factor in Africa and the Caribbean, it is probably not the limiting factor in Asia, Europe or North or South America. Indeed, the policy stance in Europe (for instance, the EU Water Framework directive of October 2000) indirectly curtails the growth of fertiliser usage. The problems are two-fold: (a) fertilisers are a major pollutant of water supplies, and (b) recent academic studies have highlighted that nitrous oxide, released from the Nitrogen contained in fertilisers, is 296 times more potent than carbon dioxide as a greenhouse gas. Over-use of fertilisers could seriously undermine the environmental arguments for substituting fossil fuels with biofuels.

The table below sets out the major listed providers of fertilisers.

Growth is likely to be strongest where fertiliser use is low (Africa) or where acreage is expanding rapidly

From a top-down perspective, we would look at stocks that are exposed to areas of currently low (or relatively low) fertiliser use or where acreage is expanding rapidly. For example, **Omnia Holdings** (in South Africa), which offers exposure to demand growth for fertilisers across Sub-Saharan Africa as well as Madagascar, Australia and New Zealand. **Fosfertil** and **Heringer** are the two largest listed fertiliser providers in Brazil. Forty percent of **Bunge's** normalised operating profit comes from its fertiliser business in Brazil, including a controlling share of the ownership of Fosfertil. Our top picks in the US are **Agrium** and **Mosaic**. Agrium offers a good balance between nitrogen, phosphate and potash, a strong operating record, substantial exposure to retail distribution and specialty fertiliser products (such as controlled-release nitrogen, which is one way to mitigate the negative environmental impact of over-using fertilisers).

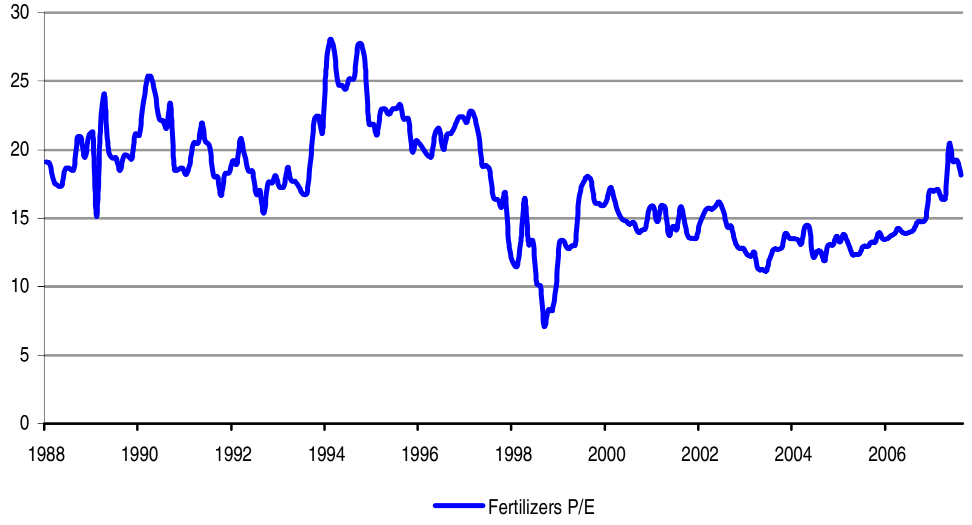
At the other end of the spectrum, we recommend avoiding stocks that look fairly fully priced and offer more limited growth potential (i.e. with greater exposure to European and some Asian markets) in areas where fertiliser is over-used and at risk from regulation. This fits with our Underperform ratings on **K+S** (in Germany) and **Sinofert** (Hong Kong listed).

Figure 60: **Listed fertiliser producers**

Stock	Listing	Description	Mkt Cap (US$m) (30/10/07)	Rat	2008E P/E	2008E P/sales
Incitec Pivot	AUS	100% of revenues from the manufacture and distribution of fertilisers	3,819	R	N/A	N/A
Wesfarmers	AUS	Hardware acctd for 48% of fis 2006 revs; energy, industrial & safety & insurance, 45%; chemicals & fertilisers, 6% & other, 1%	15,018	U	19.2	1.8
Fosfertil	BRA	Largest fertiliser provider in Brazil. Fertilizers accounted for 77% of 2006 revenues; chemicals, 20% and services, 3%	3,395	NR	19.1	1.8
Agrium Inc.	CAN/US	The Wholesale division (produces and markets agricultural nutrients, mostly to N America) accounted for 53% of 2006 revenues; the Retail division (distribution of seed, agricultural chemicals and fertilizer direct to growers), 47% of 2006 revenues	7,395	O	14.6	1.4
Potash Corp.	CAN/US	Nitrogen accounted for 36% of 2006 revenues; Phosphate 33% and Potash, 31%	34,600	N	24.0	6.7
Soquimich	CHI	Produces and distributes fertilizers, iodine, lithium and its derivatives	4,801	NR	27.0	3.4
China BlueChemical	CHN	Fertilizers accounted for 86% of 2006 revenues; methanol, 9% and other, 5%	2,745	NR	22.0	3.1
Auriga Industries	DEN	Chemical Industry (pesticides) accounted for 78% of 2006 revenues; Agricultural Machinery , 17% and Insulation Materials, 5%	844	NR	16.3	0.8
K+S	GER	Potash & Magnesium Products acctd for 42% of 2006 revs; Fertiva, 19%; Compo, 18%; Salt, 16%; Waste Management, 3% & Services, 2%	7,596	U	22.1	1.1
Sinofert	HKG	Sourcing and distribution accounted for 94% of 2006 revenues and production, 6%	5,401	U	29.1	0.9
Tata Chemicals	IND	Inorganic Chemicals accounted for 54% of fiscal 2007 gross revenues and Fertilizers, 46%	1,396	NR	11.2	0.8
United Phosphorus	IND	Manufactures agro chemicals, chemical intermediates, industrial chemicals and speciality chemicals	1,420	NR	13.7	2.6
ICL-Israel Chemicals	ISL	Fertilizers accounted for 40% of 2006 revenues; Performance chemicals, 31%; Industrial, 25%; Metallurgy, 2% and Other, 2%	10,698	NR	20.8	2.3
Israel Corp	ISL	Shipping accounted for 47% of 2006 revenues; fertilizers, 21%; performance products, 16% and others, 16%	5,635	NR	18.8	0.6
Makhteshim-Agan	ISL	Agro products accounted for 89% of 2006 revenues and Non-Agro products, 11%	3,752	NR	16.1	1.3
Dongbu HiTek	KOR	Primarily involved in the manufacture and sale of agricultural chemical products	195	NR	N/A	N/A
Chemical Co. of Malaysia	MAL	Fertilizers accounted for 48% of 2006 revenues; Chemicals, 33%; Pharmaceuticals, 18% and Other, 1%	375	NR	N/A	N/A
Yara International	NOR	The Downstream division (fertiliser distribution network) accounted for 69% of 2006 revenues; Upstream (converting natural gas into nitrogen chemicals, nitrogen, phosphorous and potash), 12%; Industrial (marketing nitrogen chemicals and gases for industrial use), 18% and Other, 1%	8,153	NR	15.9	0.9
Engro Chemical Pakistan	PAK	Primarily involved in the manufacture, purchase and marketing of fertilizers and seeds	722	NR	17.9	1.4
Fauji Fertilizer	PAK	Manufactures, purchases and markets fertilizers and nvest in other fertilizer and chemical manufacturing operations	996	NR	9.2	1.2
Ciech	POL	Soda segment accntd for 40% of 2006 rev;organic chemicals, 20%; agro-chemicals 16% ; inorganic segment, 12%; others, 12%	1,481	NR	14.1	0.8
Zaklady Azotowe Pulawy	POL	Nitrogen fertilisers and pesticides accounted for 86% of fiscal 2005 revenues	762	NR	N/A	N/A
Omnia Holdings	SAF	Chemicals division accounted for 49% of 2006 sales, Mining (exposives) division 19% and Agriculture (fertilisers) for 32%	460	NR	9.6	0.5
Syngenta	SWI	Crop Protection accounted for 79% of 2006 revenues; Seeds, 21% and the balance from the Plant Science division	19,095	NR	21.0	2.2
Taiwan Fertilizer	TAI	Sales are primarily derived from the manufacture and distribution of organic and inorganic chemical fertilizers	2,390	O	23.0	5.2
Bunge		40% of operating profits are accounted for by fertilizer in Brazil, including a controlling share in Fosfertil	12,933	O	21.7	0.3
CF Industries	US	Nitrogen Fertilizer accounted for 75% of 2006 revenues and Phosphate Fertilizer, 25%	4,469	N	20.2	0.7
Dow Chemical	US	Perf Plastic acctd for 28% of 2006 revs; Plastic, 24%; Perf Chem, 16%; Hydrocarbon, 13%; Chem, 11%; Agri Prod, 7% and Other, 1%	42,379	N	13.1	0.8
Mosaic	US	Phosphates division accounted for 53% of fiscal 2006 revenues; Offshore (comprising port facilities, blending and distribution operations), 23%; Potash, 21%; Nitrogen, 2% and Other, 1%	27,769	O	23.2	1.5
Scotts Miracle-Gro Co	US	Mostly domestic fertiliser sales. North American lawn fertiliser sales accounted for 71% of fiscal 2006 revenues, International Products, 15%, Lawn Services, 8% and Corporate 6%	2,755	NR	16.3	1.3

Source: I/B/E/S consensus estimates for Not Rated stocks, Credit Suisse estimates

Figure 61: Global fertiliser stocks: 12-month forward P/E



Source: I/B/E/S, Credit Suisse research

(c) Agricultural genetics

Biotechnology has been used to boost crop yields by increasing the efficiency of the photosynthetic process in plants, increasing resistance to pests, raising drought tolerance and promoting stronger root systems, to name a few examples. Successes attributed to biotechnology include 5–15% yield increases from the use of bioengineered rice in the Shanghai region of China, 10% yield improvements in the US using genetically engineered corn and 40% increases in yields of cardamom in India using tissue-cultured plants.

The growth in acreage devoted to transgenic (or genetically modified, GM) crops has increased significantly since they were first commercially introduced in the US in 1994.

In 1996, the ISAAA (International Service for the Acquisition of Agri-biotech Applications) estimated that 1.7m hectares globally were dedicated to GM crops in just six countries; by 2006, this had increased to 102m hectares across 22 countries with a value of US$6.2bn in sales. The bulk of the commercially available GM crops come down to four types: soybeans, corn, cotton and canola. 26% of the global area planted with these four crops in 2006 was classified as GM (51%, 12%, 24% and 15%, respectively, for soybeans, corn, cotton and oilseed rape). GM crops are common in the US (where GM food does not have to be labelled), Canada and Argentina and have become more widespread in recent years in China and India. In general, public opinion remains firmly opposed to GM crops in Europe. European Food and Feed legislation requires labelling on almost all GM products with a threshold on the accidental presence of GMOs in food products set at 0.9%. Only six out of 25 of the European markets have approved any use of GM crops.

In 1996, 1.7m hectares worldwide were dedicated to GM crops; by 2006 102m hectares were dedicated to GM crops

Figure 62: **Cultivation areas for GM crops in 2006**

The US has the largest area of land planted with GM crops; Argentina has the largest proportion of land planted with GM crops

	GM Acreage (Mn hectares)	Type of GM Crops planted	As % total arable acreage
US	54.6	S,M,C,R, Squash, Papaya, Alfalfa	31.1%
Argentina	18.0	S,M,C	62.3%
Brazil	11.5	S, C	17.3%
Canada	6.1	R,M,S	11.7%
India	3.8	C	2.2%
China	3.5	C	2.3%
Paraguay	2.0	S	63.8%
South Africa	1.4	M,S,C	8.9%
Uruguay	0.4	S,M	28.3%
Philippines	0.2	M	1.9%
Australia	0.2	C	0.4%
Romania	0.1	S	1.0%
Mexico	0.1	C,S	0.4%
Spain	0.1	M	0.5%
Colombia	<0.1	C	<2.6%
France	<0.1	M	<0.5%
Iran	<0.1	Rice	<0.5%
Honduras	<0.1	M	<7.0%
Czech Republic	<0.1	M	<3.0%
Germany	<0.1	M	<0.8%
Portugal	<0.1	M	<4.3%
Slovakia	<0.1	M	<6.4%
Global total	**102**		**6.6%**

Source: ISAAA, FAO, Credit Suisse research
S = Soybeans, M= Maize, R = Rapeseed, C = Cotton.

Critics of GM crops point out various disadvantages.

GM crops present various disadvantages

1) Although there is little evidence to support it, there are claims that GM crops could have unforeseen, adverse health effects on consumers through the ingestion of toxic proteins or transferring antibiotic-resistance and other genes to human gut bacteria.

2) A potentially more plausible threat is that modified crops could become pernicious superweeds (much like the invasive water hyacinth) or that they could accidentally breed with wild plants or other crops—genetically polluting the environment. Field trials, carried out by the UK government, reveal that gene transfer does occur. One 2002 study showed that transgenes had spread from the US to traditional corn varieties in Mexico. A 2004 study revealed that conventional varieties of major US food crops have also been widely contaminated.

3) It is also thought that insect-repelling plants will speed the evolution of insecticide-resistant pests (much like the evolution of MRSA, which developed alongside mass application of anti-bacterial solutions) or that there are unintended consequences through the creation of a biological imbalance in an area. Hence, 'normal' crops are often grown alongside transgenic ones as refuges for pests, in an attempt to prevent their accelerated evolution into 'superpests'. Legislation backing the introduction of boll weevil resistant cotton in India requires that 20% of the acreage is planted with non-GM cotton seed.

4) It may also be the case that growing GM crops affects farmland biodiversity. Field trials have so far proved inconclusive.

5) GM crops can be modified to render any seeds infertile. This reduces the risk of generating a 'superweed' and prevents genetic pollution but forces farmers to buy new seed every year and potentially become dependent on a few seed producers. Monsanto has said it will not pursue the roll-out of infertile crops so that it doesn't force seed dependency.

The pressure on global agricultural producers to produce larger quantities for food and fuel use creates an incentive for these concerns to be discounted in favour of greater production through the use of GM.

The GM market is dominated by a handful of major players, including Monsanto, Syngenta, DuPont, Bayer, Dow and BASF.

Figure 63: **GM Crop participants**

	Main listing	Description	Mkt Cap (US$bn) (30/10/07)	Sales 2006 (US$m)	2002–06 Sales CAGR	2002–06 EPS CAGR	2008E P/E	2008E P/sales
Monsanto*	US	Two divisions: Seeds and Genomics (55% of fiscal 2006 revenues focussing on seeds and biotechnology) and Agricultural Productivity (45% 2006 revenues focussing on herbicides). The two divisions are complementary: Seeds and Genomics produces, amongst other things, Round-Up Ready crops designed to withstand the application of the Round-Up herbicide produced by the Agricultural Productivity division.	50.8	7,344	12%	35%	35.9	3.9
Syngenta*	SWI	Crop Protection (herbicides, insecticides and fungicides accounted for 79% of 2006 revenues; Seeds, 21% and Plant Science (bio-technology), nominal	25.8	8,046	7%	49%	21.0	2.2
Bayer*	GER	Healthcare accounted for 42% of 2006 revenues; Material Science, 37% and Crop Science, 21%	101.5	40,538	1%	9%	16.8	1.1
DuPont*	US	The agriculture and nutrition division accounted for 22% of revenues in 2006. This incorporates Pioneer, the largest seed company in North America. Pioneer produces hybrid and varietal seeds, and provides insect protection and herbicide tolerance.	44.4	27,421	3%	16%	14.2	1.6
Dow	US	Dow Agri Production division accounted for 7% of total revenues in 2006. Within this the seed division is called "Mycogen", and is roughly the fifth largest global seed producer.	42.0	49,124	15%	85%	13.1	0.8
BASF*	GER	Largely a chemicals and plastics business but agri-products accounted for 6% of sales in 2006 and they have recently entered a JV with Monsanto on biotech collaboration.	67.7	73,654	15%	27%	12.9	0.7

*Source: *I/B/E/S consensus estimates for Not Rated stocks, Credit Suisse estimates for Dow*

How big is the potential market?

Monsanto estimates that its technology will be applicable (i.e. legally accepted) across roughly 480m acres (192m hectares) by 2010. This is nearly twice the current acreage dedicated to GM crops across the world. That is not to say that Monsanto or the other GM providers will manage to penetrate all this potential, but it does serve as a description of the potential market size.

The ISAAA points out that while by 2006 22 countries had planted commercialised biotech crops, an additional 29 countries had granted regulatory approvals for biotech crops for import for food and feed use and for release into the environment. It estimates that biotech crops will be commercially grown in 40 countries (or more) across 200m hectares by 2015.

The ISAAA estimates that GM acreage will roughly double over the next eight years

Biofuel demand is potentially one avenue that could see some acceptance of GM crops even in Europe. Syngenta, for example, has applied for permission to import a GM corn into Europe for processing into fuel. This GM corn variety has been modified to express an enzyme that shortens the time it takes to ferment to alcohol. Last year, President da Silva of Brazil declared that GM soybeans will be used for biofuels, while ‘good soybeans’ will be kept for human consumption.

The other key driver of GM expansion is likely to be the development of drought-tolerant strains. Drought has affected a large proportion of agricultural production across Australia, the US, Africa and parts of Europe in recent years. However, we note that Monsanto seems fairly pessimistic on the prospects for any growth of its products in Europe, since they have omitted the region from their strategic business plan.

Drought-tolerant corn and cotton are still at a relatively early stage in Monsanto's R&D pipeline but are highly likely to be successfully introduced commercially, and we believe each has significant market potential. Monsanto expect drought-tolerant corn to be commercialised around 2012–15. Management estimates a potential 164m acreage opportunity globally with an anticipated value per acre of US$10–30, representing a US$1bn–5bn market opportunity (versus 2006 sales of US$7.3bn). Drought-tolerant cotton is more likely to be a post-2015 event. Monsanto has said it anticipates a 36m acreage opportunity globally at a value per acre of $10–30, representing a US$300m to US$1bn market opportunity. In addition to Monsanto, several other companies are working towards the development of drought-tolerant crops. These include DuPont (corn), Syngenta (corn and soybeans) and BASF, which signed a collaborative agreement with Monsanto in March 2007.

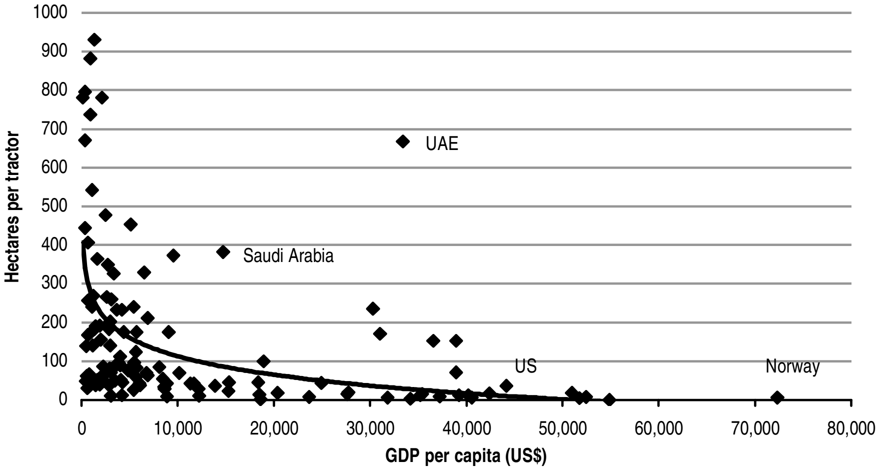
Monsanto (along with DuPont and Syngenta) is working on drought-tolerant crops

(d) Machinery and equipment

Rising farm profitability is likely to spur stronger sales in equipment (new and replacement) in emerging and developed markets. Relative farm size (less than one acre on average in China) means that it is very unlikely that tractor and machinery usage will get anywhere near the ratios of the US (where the USDA 2002 Agriculture Census showed that farms were an average of 441 acres, or 179 hectares). That said, there is still a wide gulf between machinery usage in the developed world compared to the emerging markets. In Brazil, where farms are an average 67 hectares, there is only one tractor to every 83 hectares. The EU-15 has an average farm size of just 19 hectares, yet there is one tractor to every 28 hectares.

In Brazil, where farms are an average 67 hectares, there is only one tractor to every 83 hectares. The EU-15 has an average farm size of just 19 hectares, yet there is one tractor to every 28 hectares

Figure 64: **Tractors per hectare versus GDP per capita**



Source: FAO, IMF, Credit Suisse estimates

Farmers have begun to apply "precision agriculture" tools like digital sensors, communication links, global positioning systems and computers to match agricultural inputs and practices to variable conditions within a field. For example, digital control systems on a tractor can determine how much fertiliser and pesticide to apply and put them exactly where needed. The benefits are higher yields, cost savings for fertilisers and pesticides, reduced environmental impact and higher-quality produce. However, the initial costs of applying precision agriculture techniques can be high, and their impact is still very limited. Currently, only about 4% of farms in the US and a very limited number of farms in Western Europe have adopted these practices, according to the FAO. The developing world is obviously much further behind on this front and will probably remain so for some time.

Figure 65: **Agricultural machinery and equipment**

Stock	Main listing	Description	Mkt Cap (US$m) (30/10/07)	Rating	2008E P/E	2008E P/sales
Punjab Tractors Ltd	India	Manufacturing, marketing and servicing of tractors	415	NR	12.4	2.0
United Tractors	Indonesia	Mainly focused on construction and mining machinery but agricultural equipment a small part of the business	3,200	Underperform	22.3	1.8
Carraro	Italy	Designing, manufacturing and marketing of automotive transmission systems and components for tractors, construction equipment, materials handling equipment and light commercial vehicles and cars.	502	NR	18.0	0.6
Iseki & Co. Ltd.	Japan	Grading machines acctd for 30% of fis 2006 revs; harvesters, 20%; parts, 20%; other business, 16%; cultivation mach, 7%; & other, 7%	451	NR	13.9	0.4
Kubota Corp.	Japan	Combustion engine & machinery accounted for 63% of fiscal 2006 revenues; indtl castings, 18%; environmental eng, 10% & other, 9%	10,705	Neutral	14.5	1.2
AGCO Corp.	US	Tractors acctd for 67% of 2006 revs; Replacement parts, 14%; Other machinery, 10%; Application Equipment, 5% & Combines, 4%;	4,644	Neutral	21.5	0.5
CNH Global (89% owned by Fiat)	US	Agricultural equipment accounted for 64% of 2006 revs; construction equipment accounted for 36%. Financial services also contribute to the bottom line.	12,256	NR	17.0	0.9
Deere & Co.	US	Agricultural Equip acctd for 46% of 2006 revs; Construction & forestry, 26%; Comm & Consumer Equip, 18%; Credit, 8% & Other, 2%	31,959	Outperform	16.8	1.0
Gehl	US	Design and manufactures machinery for the light construction and agricultural industry	271	NR	NA	NA
Lindsay Corp.	US	Irrigation Equipment accounted for 86% of fiscal 2006 revenues and Infrastructure,14%	558	NR	29.5	1.7

Source: I/B/E/S consensus estimates for Not Rated stocks, Credit Suisse estimates

Our top pick in the sector is **Deere**. Deere makes and distributes a full range of agricultural, industrial, commercial and consumer equipment. Deere also provides credit services, property and casualty insurance, and health management programmes. Sales and earnings growth have averaged 12% and 33%, respectively, over the past three years. Booming crop prices typically feed through to farm equipment sales within one season. We expect sales to remain robust, driven by the strength in Brazilian and North American farming into 2008 and beyond. In her recent report *Deere: Takeaways from management meetings*, dated 4 September 2007), Credit Suisse analyst Jamie Cook pointed out that Deere is adding temporary workers and additional machine tooling to prepare for the upturn. There is also considerable share opportunity in Brazil, where Deere has captured 35% of the combine market but only 8–10% of the tractor market.

Recent share price weakness has been an opportunity for Credit Suisse to upgrade **AGCO** to Neutral (*Revisiting AGCO*, dated 4 September 2007). AGCO is the third-largest manufacturer of farm equipment, with a significant share in Europe and South America. On top of what could be one of the most fruitful farm cycles to date, margin expansion opportunities are significant as AGCO transitions from an acquisition-driven company to an operating company. AGCO has several initiatives in place that are aimed at improving profitability, including: 1) reducing suppliers and material costs via sourcing in lower-cost countries; 2) simplifying manufacturing processes; 3) lowering overhead and improving asset utilisation; 4) improving share and profitability in North America; and 5) targeting developing markets like Eastern Europe and China. We forecast revenues can reach US$9bn on operating margins of 8% based on these internal initiatives and increased evidence that the overseas farm markets are recovering. This suggests 2011E peak earnings of US$4.70 per share on US$9.2bn in revenues (this represents 176% growth, or a CAGR of 23% from 2007 forecast earnings of US$1.70 per share).

Kubota is one of Japan's leading farm equipment providers. Sales are up 5% over the last two years, but bottom-line EPS growth has suffered (down 9%). The key differences with Deere are (a) the lower percentage of sales from farm equipment (27% versus 46% of total sales for Kubota and Deere, respectively), and (b) a greater dependence on small tractor sales (which have deteriorated with the downturn in the US housing market). Meanwhile, Kubota's earnings in pipes, valves and industrial castings (c15% of operating profit) have suffered from margin compression on the back of rising scrap metal prices.

Appendix 1: Calculating demand growth for agricultural output from biofuels expansion

We believe that global food production probably needs to grow at 2.5% per year (roughly in line with the historical pace of 2.2%) just to keep pace with global dietary needs. The bad news is that grain and oilseed production growth has already been lagging consumption over the past 20 years even before the recent boom in biofuels demand.

Figure 66: **World grain and oilseed production and consumption trends**
(in millions metric tonnes)

	1986/1987	2007/2008	10 yr CAGR	20 yr CAGR
World Grain and Oilseed Production	1,260	1,850	1.8%	1.9%
World Grain and Oilseed Consumption	1,212	1,867	2.2%	2.2%
Includes corn, mixed grain, copra, cottonseed, palm kernel, peanut, rapeseed, soybeans, sunflower, sorghum and wheat. Excludes barley and oats.				
World Grain Production	1,070	1,459	1.5%	1.6%
World Grain Consumption	1,020	1,463	1.8%	1.8%
World Oilseed Production	190	391	3.2%	3.7%
World Oilseed Consumption	192	404	3.9%	3.8%

Source: USDA PSD

This has led to a precarious situation in global inventories for grains and oilseeds. Stocks-to-use ratios are at all-time lows.

Figure 67: **Ending world stocks of major grains/oilseeds as % of total consumption (in m metric tonnes)**

Year	*Major Grains/Oilseeds*		*Corn*		*Wheat*		*Soybeans*	
1998/99	439.7	28.9%	190.4	32.8%	207.9	36.0%	29.3	18.5%
1999/00	445.6	28.7%	192.9	32.1%	208.5	35.9%	30.9	19.4%
2000/01	423.2	27.0%	173.7	28.6%	205.8	35.3%	34.2	19.9%
2001/02	400.0	25.0%	150.3	24.2%	201.8	34.4%	36.1	19.6%
2002/03	345.0	21.3%	125.6	20.0%	166.3	27.6%	43.6	22.8%
2003/04	286.1	17.5%	103.9	16.0%	132.5	22.8%	38.7	20.5%
2004/05	344.4	19.8%	130.7	19.0%	151.0	24.8%	48.4	23.6%
2005/06	342.4	19.3%	122.8	17.5%	149.2	24.1%	54.0	25.1%
2006/07	302.3	16.7%	100.2	13.9%	124.9	20.2%	64.5	28.9%
2007/08	279.9	15.0%	102.2	13.3%	114.8	18.6%	51.6	22.1%

Source: USDA/FAS, PSD database, Credit Suisse estimates. "Major Grains/Oilseeds" includes corn, mixed grain, copra, cottonseed, palm kernel, peanut, rapeseed, soybeans, sunflower, sorghum and wheat

At the same time, China has become a net importer of agricultural products after years of self-sufficiency. This has largely been driven by increased imports of soy and cotton. In 2007, China substantially increased imports of pork and poultry as well.

Figure 68: China's agricultural imports and exports (US$bn)

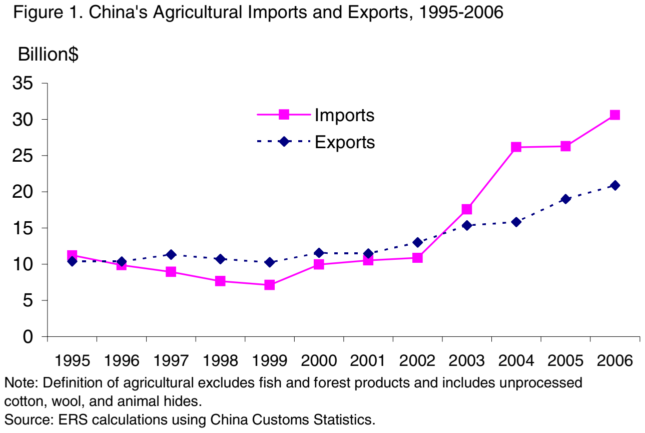
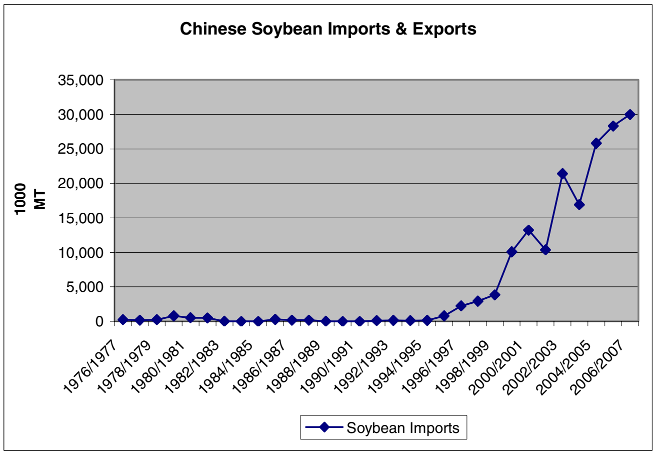


Figure 1. China's Agricultural Imports and Exports, 1995-2006

Note: Definition of agricultural excludes fish and forest products and includes unprocessed cotton, wool, and animal hides.
Source: ERS calculations using China Customs Statistics.

Source: USDA ERS

Figure 69: China's soybean imports (in metric tonnes)



Source: USDA ERS

We believe that biofuels expansion exacerbates an already precarious supply-demand situation by adding as much as an incremental 120 bps to current rates of demand growth for grain and oilseeds. Below we show the combined impact of our projections for US ethanol expansion and global biodiesel growth on the demand for grains and oilseeds.

Figure 70: Incremental demand for corn from US ethanol growth

	U.S. Ethanol Capacity Projection (B gallons)	Gallons / Bushel Estimate	U.S. Corn for Ethanol (B bushels)	U.S. Corn for Ethanol (M metric tonnes)	Incremental U.S. Corn for Ethanol (M metric tonnes)
2006	5.38	2.50	2.15	84.5	
2007	8.50	2.52	3.37	132.5	48.05
2008	10.50	2.54	4.13	162.4	29.89
2009	11.80	2.56	4.61	181.1	18.68
2010	13.00	2.58	5.04	198.0	16.87
2011	13.50	2.60	5.19	204.0	6.03
2012	14.00	2.62	5.34	209.9	5.94
	Projected 2008-2012 growth rate per year				15.48
	Current World Grain and Oilseed Consumption (M MTs)				1,867.00
	Incremental impact on annual consumption growth				0.8%

Source: USDA, Company data, Credit Suisse estimates

Figure 71: Incremental demand for oilseeds from world biodiesel growth

	Germany	Total EU biodiesel	USA Biodiesel	World Biodiesel Consumption Projection (M metric tonnes)	Incremental Vegetable Oil for Biodiesel (M metric tonnes)	Oilseeds Production Required for Oil Growth (assume 35% average oil content of seeds)
2005	1.70	3.18	0.20	3.00		
2006	2.00	4.50	0.50	6.00	3.00	8.57
2007	2.40	5.50	1.00	9.00	3.00	8.57
2008	2.60	6.50	2.20	11.00	2.00	5.71
2009	2.80	7.50	2.50	12.00	1.00	2.86
2010	2.90	8.80	2.70	15.00	3.00	8.57
2011	3.10	9.80	2.90	18.70	3.70	10.57
Projected 2008-2012 growth rate per year					2.62	6.93
Current World Grain and Oilseed Consumption (M MTs)						1,867.00
Incremental impact on annual consumption growth						0.4%

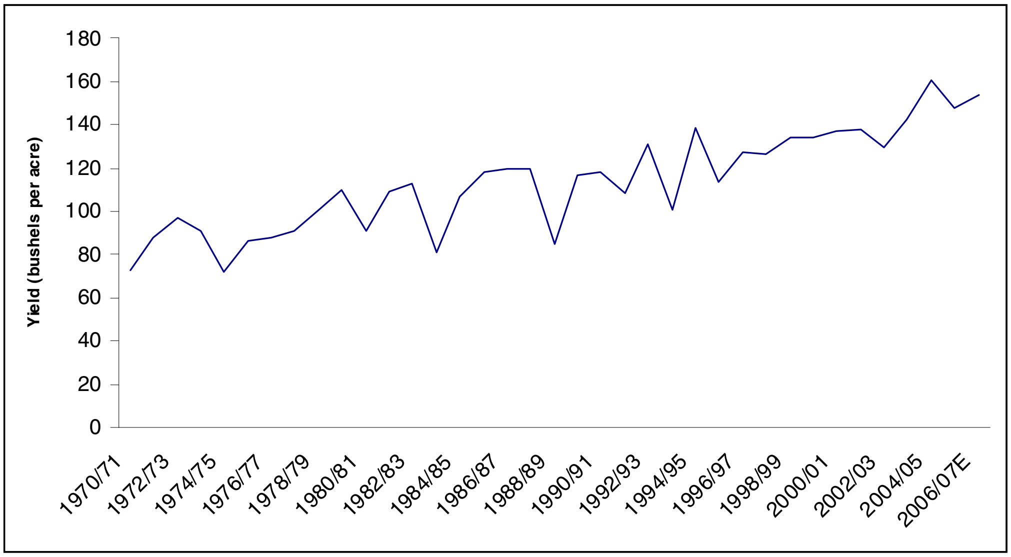
Source: USDA, Company data, Credit Suisse estimates

US corn growers responded aggressively this year to the financial incentives of rising corn prices by switching acreage away from soybeans and cotton. Corn plantings rose from 78m acres to 93m. This has driven up the value of soybeans. Wheat prices are now reaching panic levels, not so much because of the acreage shift, but because of persistent drought in Australia and a poor European harvest. These three crops account for about 66% of total world production of grains and oilseeds on a tonnage basis.

Credit Suisse believes acreage can't shift further away from soy next year without seriously threatening soy inventories. According to Credit Suisse analyst, Rob Moskow, the rule of thumb for farmers in the US is that you plant corn when soy is trading at more than a 2.5:1.0 ratio to corn on a price/bushel basis and you plant corn when it is trading at less. Right now, the futures market essentially implies a ratio of only slightly more than 2:5 (US$9.10/bushel soy and US$4 corn), which suggests that farmers are no longer financially incentivised to switch acres to corn. In addition, annual rotation from corn into soy is typically viewed as a means of breaking out of insect and disease cycles and reducing the need for nitrogen (fertiliser). So it is quite possible that soy acreage could rise in the 2008/09 crop year and corn acreage could fall.

If we just assume that farmers decrease corn acreage by 4m acres in 2008/09, and we assume that ethanol capacity grows another 2.2bn gallons, then the stocks/use ratio (inventory levels) will fall precariously low by the end of the year. Even assuming no change in acreage, American farmers would still need to increase their yield from 155 bushels per acre (our estimate for this year) to 164 bushels to produce the 0.84bn incremental bushels of corn needed for ethanol. Yields in the US are improving with GMO seed technology and sharing of best practices but have never exceeded 160.

Figure 72: **US corn yield trends**



Source: USDA

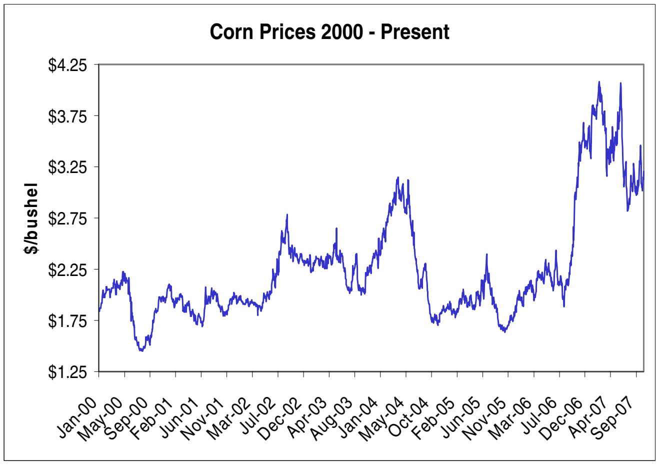
Figure 73: **Credit Suisse corn production and price projections**

Production (mmgy)	**2003/04A**	**2004/05A**	**2005/06A**	**2006/07**	**2007/08**	**2008/09**
Fuel Ethanol Production	2,810	3,410	4,000	5,375	8,320	10,738
Corn Acreage (in M)	78.6	80.9	81.8	78.3	93.6	89.0
Corn Acreage Harvested (in M)	70.9	73.6	75.1	70.6	86.1	82.0
Corn Yield (bushels/acre)	142.2	160.4	148.0	149.1	154.7	155.0
Corn Harvest (M bushels)	10,089	11,807	11,114	10,535	13,318	12,710
Beginning Stocks	1,087	958	2,114	1,967	1,304	1,997
Production	10,089	11,807	11,114	10,535	13,318	12,710
Imports	14	11	9	12	15	20
TOTAL SUPPLY	11,190	12,776	13,237	12,514	14,637	14,727
Feed and Residual	5,789	6,162	6,141	5,600	5,700	5,800
Food, Seed & Industrial	2,537	2,686	2,981	3,485	4,590	5,534
Corn for Ethanol (M bushels)	1,168	1,323	1,603	2,125	3,200	4,130
% of Production	12%	11%	14%	20%	24%	32%
Other FS&I	1,369	1,363	1,378	1,360	1,390	1,404
Exports	1,897	1,814	2,147	2,125	2,350	2,200
TOTAL USE	10,232	10,662	11,270	11,210	12,640	13,534
TOTAL ENDING STOCKS	958	2,114	1,967	1,304	1,997	1,193
Stocks/Use Ratio	**9.4%**	**19.8%**	**17.5%**	**11.6%**	**15.8%**	**8.8%**
Estimated Price Per Bushel				$3.04	$2.90-$3.50	$4.00+

Source: Company data, Credit Suisse estimates for 06/07, 07/08 and 08/09

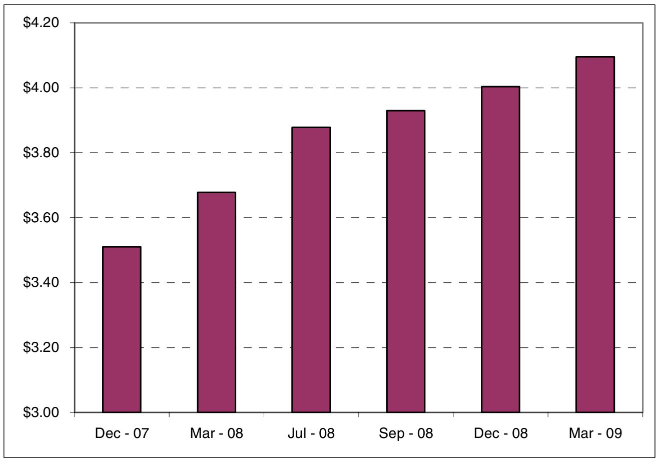
This is why the futures market is forecasting continued strength in grain prices across the board through 2008. We think this is a reflection of a new equilibrium in grain values.

Figure 74: **Cash corn prices US$/bushel**



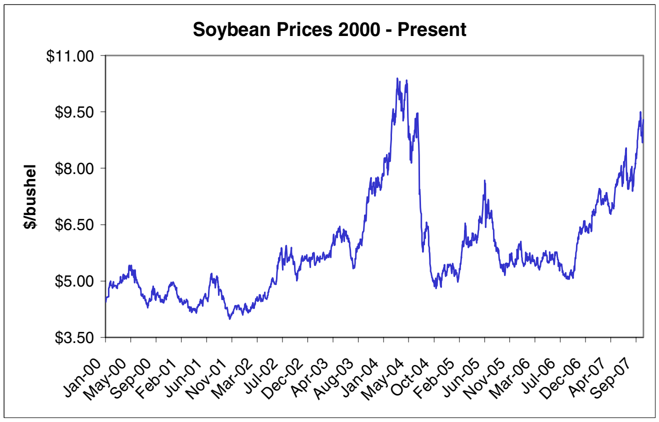
Source: CBOT

Figure 75: **Corn futures US$/bushel**



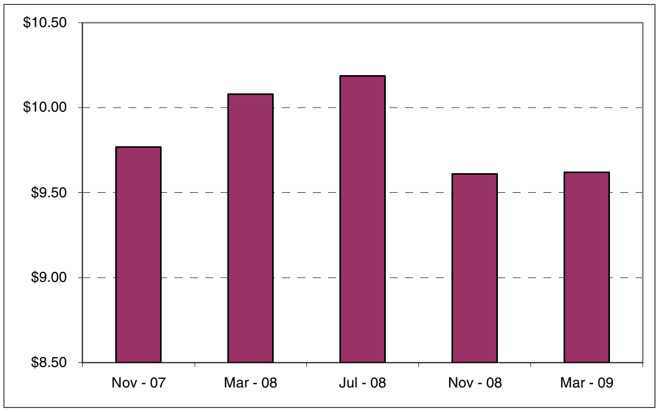
Source: CBOT

Figure 76: **Cash soybean prices US$/bushel**



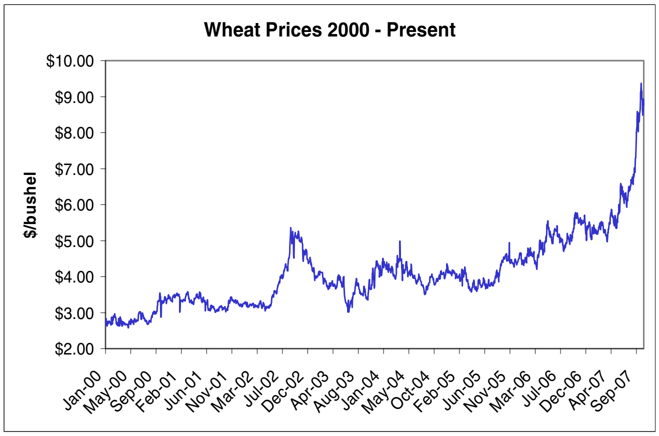
Source: CBOT

Figure 77: **Soybean futures US$/bushel**



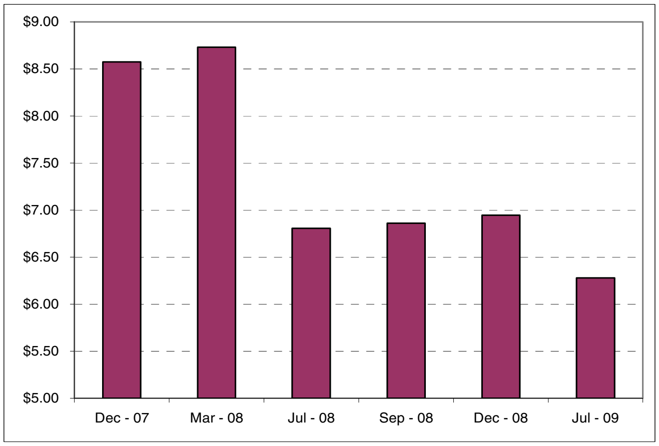
Source: CBOT

Figure 78: **Cash wheat prices US$/bushel**



Source: CBOT

Figure 79: **Wheat futures US$/bushel**



Source: CBOT

The common justification for ethanol expansion by US corn and ethanol advocates is that farmers around the world will respond to the rising prices environment for corn by increasing production. However, Figure 80 indicates how little the rest of the world has contributed to world corn production growth despite the allure of better prices. EU corn production was hampered by bad weather.

Figure 80: **Global corn production (in m metric tonnes)**

	2006/07	2007/08	Change	% of Total
United States	268	338	71	44%
China	145	143	(2)	19%
Brazil	51	50	(1)	7%
EU-27	39	32	(8)	4%
Mexico	22	23	1	3%
Argentina	23	23	-	3%
India	15	16	1	2%
Canada	9	11	2	1%
South Africa	7	11	4	1%
Nigeria	8	9	1	1%
Other	117	115	(3)	15%
World	703	769	66	100%

Source: USDA WASDE

One of the obstacles to world corn expansion is that corn is a fertiliser-intensive crop and fertiliser prices are rising. Another problem is that corn is a sensitive crop that requires rich soil and substantial rainfall. Given these factors, it is hard for us to see how another 30m metric tonnes of ethanol expansion in 2008/09 from the US wouldn't drive corn prices higher. US ethanol is simply too big and the rest of the world effectively too small.

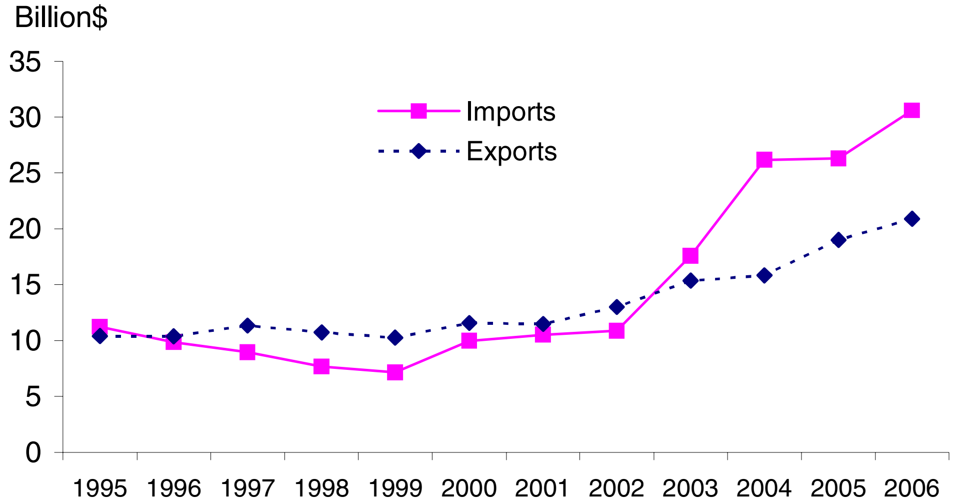
Appendix 2: China's increasing demand for agricultural imports

We believe that China's ability to satisfy its food demand with domestic resources is increasingly at risk. Food prices have escalated this year as a result of disease in the country's pig supply and a poor wheat crop. China's CPI index rose 6.5% in August compared to 5.6% the prior month. Meat and poultry prices rose 49% from the prior year and grain prices rose 6.4%.

China's total agricultural imports have grown from $10.8bn in 2002 to $30.6bn in 2006. Grain and oilseeds demand is the biggest driver of the growth, followed by cotton and wool. China is now one of the top four importers of agricultural products. China's agricultural imports have accelerated over the past three years. As part of its commitments to entering the WTO, China slashed its average agricultural tariff by 15% and opened up large quotas for imports.

Figure 81: China's agricultural imports and exports (1995–2006)

Figure 1. China's Agricultural Imports and Exports, 1995-2006



Note: Definition of agricultural excludes fish and forest products and includes unprocessed cotton, wool, and animal hides.
Source: ERS calculations using China Customs Statistics.

Source: ERS calculations using China Customs Statistics

Rising food prices could potentially destabilise the populace, given that 28% of China's disposable income goes toward food compared to just 10% in the US. This is why the Chinese government has taken such great pains to assure the Chinese public that it will protect consumers and fund reinvestment in the country's pig supply. Officials recently said that they would distribute US$200m to 253 counties for reconstruction of pig farms, the purchase of pig 'thoroughbreds' and vaccines.

In addition, China has been materially increasing its protein imports for the first time. In prior years, the US has exported only the parts of the animal that Americans generally do not eat, like intestines, ears and feet. This is changing. China's major trading company COFCO recently agreed to accept 60m lbs (27,000 metric tons) of pork carcasses by the end of December from the leading US pork company, Smithfield Foods. US exports of pork to China are up 82% year-to-date through July.

Figure 82: US pork exports

Carcass weight, in millions of pounds

	1999	2000	2001	2002	2003	2004	2005	2006	Jan-Jul 2006	Jan-Jul 2007	% change
Japan	542.29	582.96	742.22	775.95	793.34	920.85	1045.96	1015.42	588.09	633.81	7.8%
Canada	127.12	138.81	186.23	188.35	191.51	234.37	302.21	324.94	182.24	187.53	2.9%
Mexico	167.30	291.45	318.48	313.70	349.98	532.64	538.23	608.94	364.89	253.75	-30.5%
Russia	123.03	27.22	82.33	41.40	16.39	67.07	94.10	208.74	132.13	108.55	-17.8%
South Korea	55.21	41.84	38.69	70.84	79.64	71.18	190.09	293.42	160.69	157.48	-2.0%
China Mainland	NA	NA	NA	23.80	44.66	84.38	110.58	111.94	58.94	107.27	82.0%
Caribbean	21.08	15.36	23.50	20.35	16.12	24.41	40.18	61.70	39.66	27.32	-31.1%
Other	194.83	145.29	140.40	173.26	225.15	245.65	344.78	369.99	219.98	221.67	0.8%
Total	1230.87	1242.93	1531.85	1607.64	1,716.77	2,180.53	2,666.12	2,995.10	1,746.62	1,697.37	-2.8%

Source: FAS, USDA

US exports of chicken to China are up 62% in volume through July, including feet, and 12.9%, excluding feet, despite record high prices for dark meat.

Figure 83: US chicken exports by country

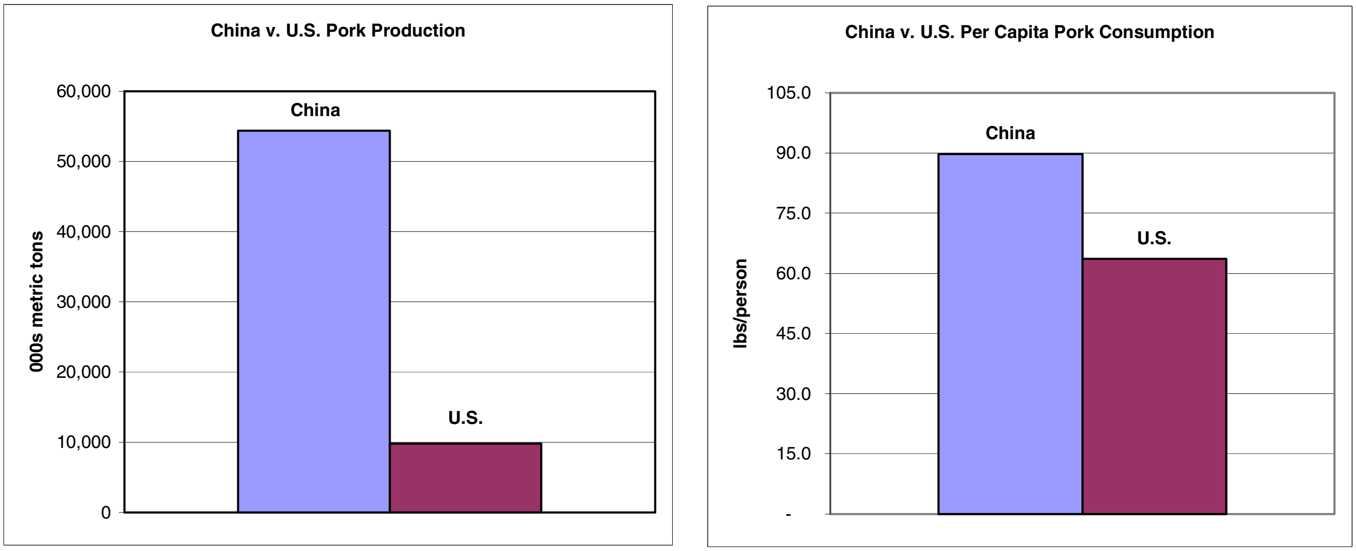
millions of pounds

	1999	2000	2001	2002	2003	2004	2005	2006	Jan-Jul 2006	Jan-Jul 2007	% Change
Hong Kong/China	1,227	918	745	607	596	264	348	639	366	413	12.9%
Mexico	299	351	381	324	364	431	522	457	294	230	-21.7%
Japan	218	230	235	121	102	69	63	63	41	29	-28.1%
Russia	694	1,262	2,304	1,521	1,521	1,502	1,681	1,555	893	997	11.6%
E. Europe	NA	NA	NA	401	519	174	219	122	118	5	-96.0%
Others	2,437	2,103	1,842	1,833	1,819	2,344	2,370	2,369	1,305	1,465	12.2%
Total	**4,875**	**4,864**	**5,506**	**4,807**	**4,920**	**4,783**	**5,203**	**5,205**	**3,018**	**3,140**	**4.0%**
China Paws & Feet	32	34	40	29	102	14	141	338	155	456	195.2%
HK Paws & Feet	290	434	575	318	342	224	144	61	43	45	4.2%
Total HK/China (incl Paws/Feet)	**1,549**	**1,386**	**1,360**	**954**	**1,039**	**502**	**632**	**1,038**	**564**	**914**	**62.2%**

Source: USDA

China is the biggest pork consumer in the world with a consumption rate 50% higher than the US on a per capita basis. China's pork production is 52m metric tons per year which is 5 times higher than that of the US (on an absolute basis). So China would only have to import a small percentage of its domestic demand from the US to have an outsized impact on US pricing and inventories.

Figure 84: **Chinese pork production and consumption compared to the US**



Source: USDA

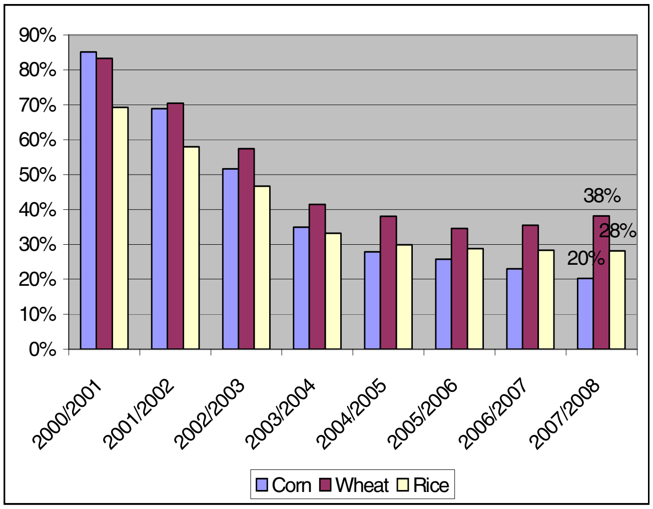
Will pork imports accelerate? Certainly there is the potential to grow this agreement, but how the situation plays out is hard to predict. As China tries to clean up the food safety violations that have threatened its viability in the export markets, it is also increasing oversight of food imports from the US and instituting quarantines. We think there is more volatility to come as China balances its needs for combating price inflation with political sensitivities and the commonly-held view that the domestic food supply is an integral part of national security. We think investors should recognise the continued threat of trade disruption from these issues. They should also keep in mind that many Chinese importers tend to be ‘bargain hunters’, so they may not want to pay high prices for US pork for very long.

But if the disease issue is a serious problem, what choice does China have? We do not know the extent to which China’s hog supplies have been depleted by disease, but we believe that managing disease issues will be challenging. SFD management has said that up to 20% of China’s hog population could be affected. If Blue Ear disease is indeed PRRS (Porcine Reproductive & Respiratory Syndrome), then it could be years before China’s productivity rates return to previous levels, especially given the highly fragmented nature of the industry and the high cost of vaccination. About 80% of China’s domestic pork production comes from backyard producers operating near subsistence levels, so getting them to use expensive vaccines will take a lot of time, if it happens at all. For context, it takes approximately six months for female pigs to reach breeding age, another four months for gestation and another three months for grow-out.

Will grain imports accelerate? As China’s populace gets wealthier, it is likely to eat more protein and so will need more grain to feed its livestock. We are increasingly concerned that the country is overworking its soil to meet this demand. Double-cropping the land for wheat and corn is a common practice, and this causes erosion over time. The country is drilling deeper and deeper into its aquifer to access fresh water supplies, and this cannot continue indefinitely. Rainfall is plentiful in southern regions, and water supply is not an issue there. However, China also overuses fertiliser, and there appears to be heightened concern among its leaders that this is causing an environmental problem.

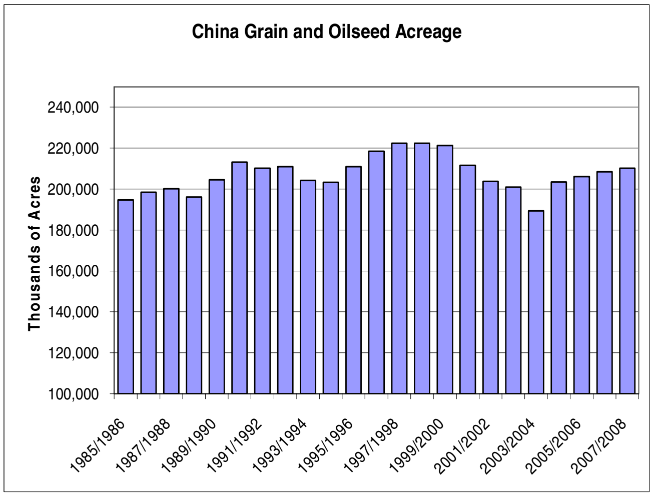
Total acres harvested for grain and oilseeds in China have been essentially flat for the past 20 years and grain inventories have declined despite slow improvements in productivity.

Figure 85: Ending grain stocks as % of usage have been declining In China



Source: USDA, PSD

Figure 86: Harvested acres In China for grain and oilseeds

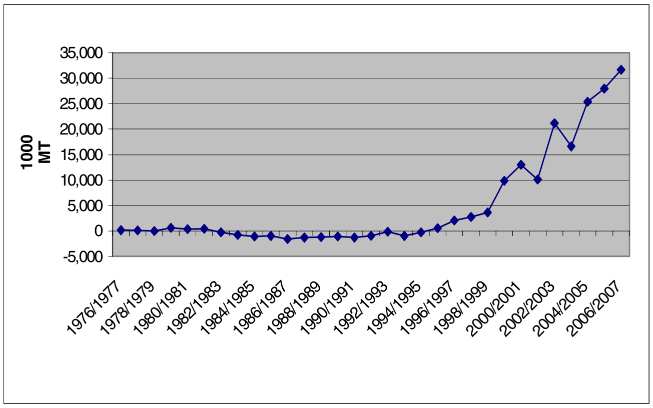


Source: USDA, PSD

China's labour advantage in agriculture could diminish over time as well as well. With 64% of its population living in rural areas as of 2000, China still has too much of its population dedicated to agricultural production. But this is down from 82% in 1979, and government officials are planning to reduce it to 50% in the next two decades.

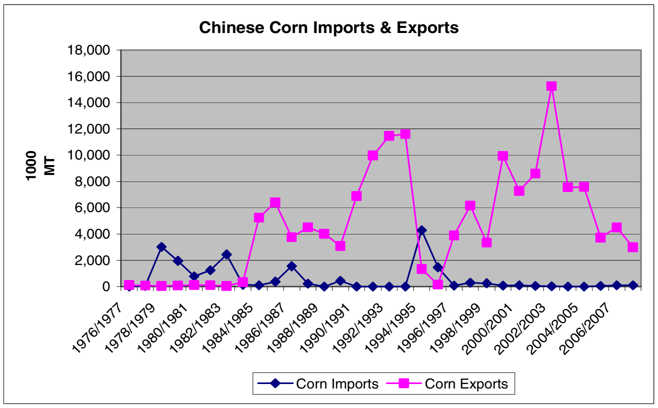
Perhaps as a result of these trends, China became a net importer of soybeans in 1996. As we think about the potential for corn exports, we believe China's net soybean import situation provides a potential analogy. China's net corn input status has bounced around in recent years and is currently expected to be a modest net positive currently. However, we believe that eventually China's corn import situation will need to take a similar tack to that of soybeans given rising demand and a declining amount of land in farm production, although whether this will take place this year or five years from now no one knows.

Figure 87: China's net soybean imports



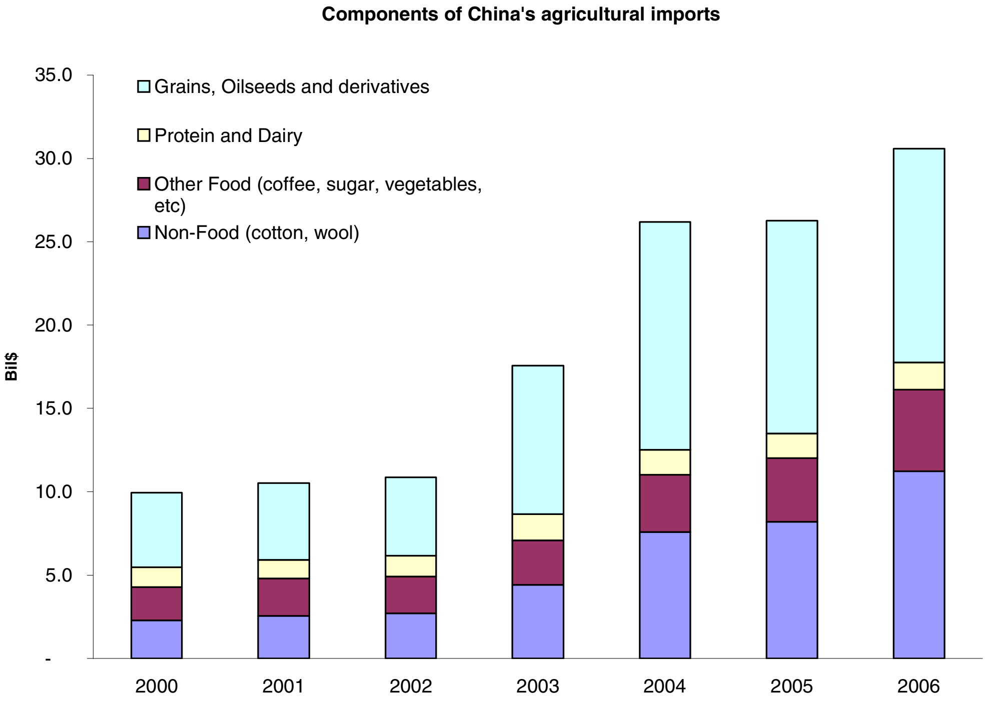
Source: USDA, PSD. In 1000 metric tons

Figure 88: Chinese corn imports and exports



Source: USDA, PSD. In 1000 metric tons

Figure 89: **Grains and oilseeds are the fastest growing components of China's agricultural imports**



Source: ERS calculations using China Customs Statistics. Definition of agricultural excludes fish and forest products and includes unprocessed cotton, wool, and animal hides.

China's land is surprisingly productive in wheat, but the US is almost twice as productive in corn. Soil quality is the primary limiting factor in addition to seed technology and pest control.

Figure 90: **Comparison of agricultural yields and input per hectare of cropland, China and US, 1997**

Item	Unit	China	World	U.S.
Production per hectare of land:				
Rice, paddy	Tons	6.2	3.9	7.0
Wheat	Tons	3.7	2.7	2.8
Corn	Tons	4.6	4.3	8.6
Soybeans	Tons	1.7	2.2	2.6
Vegetables and melons	Tons	18.4	15.7	17.1
Fertilizer consumption per hectare	Kilograms	271	94	111
Farm workers per 100 hectares*	Number	310	82	2
Land irrigated	Percent	40	18	13
Tractors per 1,000 hectares	Number	6	18	27

*For China, farm employment is the sum of those engaged in crop planting, animal husbandry, and agricultural services reported in 1997 agricultural census.

Source: USDA's ERS, FAOSTAT database

Companies Mentioned *(Price as of 30 Oct 07)*
Aeon (8267, ¥1,858, OUTPERFORM, TP ¥2,300, MARKET WEIGHT)
AGCO Corp (AG, $61.00, NEUTRAL, TP $58.00, MARKET WEIGHT)
Agrium Inc. (AGU, $60.67, OUTPERFORM, TP $66.00, OVERWEIGHT)
Ajinomoto (2802, ¥1,302, OUTPERFORM, TP ¥1,600, MARKET WEIGHT)
ALL - Am. Lat. Logistica (ALLL11, $15.11, OUTPERFORM, TP $17.00, UNDERWEIGHT)
Archer Daniels Midland Inc. (ADM, $35.00, UNDERPERFORM, TP $33.00, MARKET WEIGHT)
Associated British Foods (ABF.L, 921.00 p, NEUTRAL, TP 800.00 p, MARKET WEIGHT)
*Astral Foods (ARLJ.J, R132.36, OUTPERFORM, TP R169)
Australian Agricultural Company Limited (AAC.AX, A$3.18, UNDERPERFORM, TP A$3.25)
Banco do Brasil (BBAS3, $17.62, OUTPERFORM, TP $25.00, OVERWEIGHT)
Banrisul (BRSR6, $6.52, OUTPERFORM [V], TP $10.27, OVERWEIGHT)
Bradesco (BBDC4, $32.94, OUTPERFORM [V], TP $41.00, OVERWEIGHT)
Brasil Ecodiesel (ECOD3, $6.41, NEUTRAL [V], TP $8.60, OVERWEIGHT)
Brasilagro S.A. (AGRO3, $6.81, OUTPERFORM, TP $970.00, OVERWEIGHT)
Bunge Limited (BG, $103.11, OUTPERFORM, TP $120.00, MARKET WEIGHT)
Cadbury Schweppes (CBRY.L, 624.50 p, UNDERPERFORM, TP 560.00 p, MARKET WEIGHT)
Campbell Soup Company (CPB, $36.42, NEUTRAL, TP $41.00, MARKET WEIGHT)
Carrefour (CARR.PA, Eu49.20, NEUTRAL, TP Eu52.00, MARKET WEIGHT)
Casino Guichard (CASP.PA, Eu77.11, UNDERPERFORM, TP Eu66.00, MARKET WEIGHT)
CF Industries (CF, $83.26, NEUTRAL [V], TP $80.00, OVERWEIGHT)
Chaoda Modern Agriculture (0682.HK, HK$7.28, NEUTRAL [V], TP HK$4.90)
Charoen Pokphand Foods Public (CPF.BK, Bt5.05, UNDERPERFORM, TP Bt3.60)
China Mengniu Dairy (2319.HK, HK$33.50, OUTPERFORM [V], TP HK$38.56)
China Yurun (1068.HK, HK$13.34, UNDERPERFORM, TP HK$5.60)
CJ Corporation (001040.KS, W101,000, NEUTRAL, TP W108,000)
ConAgra Foods, Inc. (CAG, $23.29, NEUTRAL, TP $28.00, MARKET WEIGHT)
Cosan (CSAN3, $15.28, RESTRICTED [V], OVERWEIGHT)
Danone (DANO.PA, Eu58.21, OUTPERFORM, TP Eu67.00, MARKET WEIGHT)
Dean Foods Company (DF, $26.99, NEUTRAL, TP $30.00, MARKET WEIGHT)
Deere & Co. (DE, $150.55, OUTPERFORM, TP $141.00, MARKET WEIGHT)
Del Monte Foods Company (DLM, $10.02, UNDERPERFORM, TP $10.00, MARKET WEIGHT)
Dow Chemical Company (DOW, $44.14, NEUTRAL, TP $50.00, UNDERWEIGHT)
Fuji Oil (2607, ¥829, NEUTRAL, TP ¥1,000, MARKET WEIGHT)
General Mills (GIS, $56.58, OUTPERFORM, TP $65.00, MARKET WEIGHT)
Global Bio-Chem Technology (0809.HK, HK$2.96, NEUTRAL [V], TP HK$2.96)
Golden Hope Plantation (GHOP.KL, RM9.10, OUTPERFORM, TP RM10.30)
H.J. Heinz Company (HNZ, $45.61, OUTPERFORM, TP $52.00, MARKET WEIGHT)
Hormel Foods (HRL, $35.80, NEUTRAL, TP $36.00, MARKET WEIGHT)
*Illovo Sugar Limited (ILVJ.J, R22.50, OUTPERFORM, TP R29)
Incitec Pivot Limited (IPL.AX, A$89.34, RESTRICTED)
Indofood Agri Resources Ltd (IFAR.SI, S$1.85, OUTPERFORM [V], TP S$2.45)
Indofood Sukses Makmur (INDF.JK, Rp2225.00, OUTPERFORM, TP Rp2500.00)
IOI Corporation (IOIB.KL, RM7.35, OUTPERFORM, TP RM8.60)
K + S (SDFG.DE, Eu140.44, UNDERPERFORM, TP Eu78.00, OVERWEIGHT)
Kellogg Company (K, $52.43, OUTPERFORM, TP $60.00, MARKET WEIGHT)
Kraft Foods, Inc. (KFT, $32.80, NEUTRAL, TP $35.00, MARKET WEIGHT)
Kroger Co. (KR, $28.14, NEUTRAL, TP $32.00, MARKET WEIGHT)
Kuala Lumpur Kepong (KLKK.KL, RM15.20, OUTPERFORM, TP RM21.50)
Kubota (6326, ¥980, NEUTRAL, TP ¥980, MARKET WEIGHT)
Meiji Dairies (2261, ¥596, NEUTRAL, TP ¥700, MARKET WEIGHT)
Mosaic Co (MOS, $68.95, OUTPERFORM, TP $73.00, OVERWEIGHT)
Nestle (NESN.VX, SFr530.00, OUTPERFORM, TP SFr610.00, MARKET WEIGHT)
Nestle (Malaysia) (NESM.KL, RM24.40, NEUTRAL, TP RM27.00)
Nong Shim (004370.KS, W192,000, OUTPERFORM [V], TP W300,000)
Northern Foods (NFDS.L, 103.00 p, UNDERPERFORM, TP 115.00 p, MARKET WEIGHT)
Orica Limited (ORI.AX, A$31.20, NEUTRAL, TP A$33.10, UNDERWEIGHT)
People's Food Holdings Ltd (PPFH.SI, S$1.32, UNDERPERFORM, TP S$.97)
Perdigao (PRGA3, $26.32, RESTRICTED [V], OVERWEIGHT)
Petrobras (PBR, $93.70, OUTPERFORM, TP $96.00, OVERWEIGHT)
Potash Corporation of Saskatchewan (POT, $119.80, NEUTRAL, TP $122.00, OVERWEIGHT)
PT Astra Agro Lestari Tbk (AALI.JK, Rp23250.00, OUTPERFORM, TP Rp25900.00)
PT London Sumatra Indonesia (LSIP.JK, Rp10250.00, OUTPERFORM, TP Rp12500.00)
Punjab National Bank Ltd (PNBK.BO, Rs534.55, OUTPERFORM, TP Rs560.00)
Sadia (SDIA4, $6.54, NEUTRAL [V], TP $5.53, OVERWEIGHT)

Safeway Inc. (SWY, $32.86, NEUTRAL, TP $35.00, MARKET WEIGHT)
Sao Martinho (SMTO3, $13.33, OUTPERFORM [V], TP $17.00, OVERWEIGHT)
Sara Lee Corporation (SLE, $16.10, NEUTRAL, TP $16.00, MARKET WEIGHT)
Shin-Etsu Chemical (4063, ¥7,410, OUTPERFORM, TP ¥10,100, MARKET WEIGHT)
Sime Darby (SIME.KL, RM11.20, OUTPERFORM, TP RM12.20)
Sinofert Holdings Ltd (0297.HK, HK$7.52, UNDERPERFORM [V], TP HK$3.60)
SLC Agricola (SLCE3, $9.33, OUTPERFORM [V], TP $12.00, OVERWEIGHT)
Smithfield Foods (SFD, $28.11, NEUTRAL, TP $25.00, MARKET WEIGHT)
SUPERVALU INC. (SVU, $37.61, OUTPERFORM, TP $55.00, MARKET WEIGHT)
Taiwan Fertilizer Co Ltd (1722.TW, NT$82.10, OUTPERFORM, TP NT$97.20)
The Hershey Company (HSY, $42.03, NEUTRAL, TP $40.00, MARKET WEIGHT)
Tingyi (0322.HK, HK$11.30, NEUTRAL, TP HK$9.03)
*Tongaat-Hulett Group Ltd (TONJ.J, R101.75, NEUTRAL, TP R92)
Tyson Foods (TSN, $15.45, NEUTRAL, TP $15.00, MARKET WEIGHT)
Unibanco (UBB, $151.20, OUTPERFORM, TP $163.00, OVERWEIGHT)
Unilever NV (UNc.AS, Eu23.40, UNDERPERFORM, TP Eu22.50, MARKET WEIGHT)
United Tractors TBK PT (UNTR.JK, Rp11100.00, UNDERPERFORM, TP Rp6200.00)
VeraSun Energy Corporation (VSE, $12.97, UNDERPERFORM [V], TP $12.00, UNDERWEIGHT)
Wesfarmers Limited (WES.AX, A$43.75, NEUTRAL, TP A$43.50, OVERWEIGHT)
Wilmar International Ltd (WLIL.SI, S$4.18, NEUTRAL, TP S$4.30)
Wimm-Bill-Dann Foods (WBD.N, $114.57, NEUTRAL [V], TP $122.00)
Wm. Wrigley Jr. Company (WWY, $60.19, NEUTRAL, TP $64.00, MARKET WEIGHT)
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Disclosure Appendix

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